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Multiple-spindle Milling Machine.

We give with this engravings of a milling machine, which has been designed and patented by the superintendent of the shops of the Faneuil Watch Tool Co., of Boston, Mr. Edward Rivett; one of the machines having been constructed by that company, who have it now in use on watch tool work.

As will be perceived, the machine has the usual saddle and platen mounted upon suitable slides on the bed, so that it has the usual two movements at right angles to each other, either automatically or by hand.

At the rear portion of the bed rises a column, upon which is mounted, in the manner shown, a revolving sleeve *D* (Fig. 2) having three arms, which support as many vertical spindles, which may alternately be brought into position to operate upon the work by unlocking the piece *D*, and revolving it to the proper position to engage the clutch, which is on the lower end of the fixed spindle *H* (Fig. 1). The sleeves *E*, in which the spindles are placed, are moved up or down in their bearings by means of a thread, which is cut upon their exterior surfaces at the middle, as shown in the enlarged view, Fig. 3, this thread engaging with the threaded piece *d*, which is fitted and held by the screws as shown. A disk is fitted to the upper end of each sleeve, which is graduated so that the spindle may be adjusted vertically by thousandths of an inch. The piece *D* is split where the sleeves fit into it, and these can be clamped firmly in place when adjusted by the clamping nuts shown.

The spindle *H* is connected or disconnected to the cutter spindles by the lever *I*, as shown, and may be driven either directly by the belt as indicated, or through the medium of the bevel gears and cone pulley, where a slower speed and greater power are desired.

A cutter grinding attachment is shown between the two columns, which is provided with an adjustable tooth rest, and a wheel spindle which can be set at any desired angle. By this, cutters of any form can be ground in place.

A locking pin holds any desired spindle in place, or restores it to its exact former position, and by means of this machine it is possible to have three cutters all adjusted for a piece of work, and use them one after the other without disturbing their adjustment, or that of the spindles in which they are held. Roughing and finishing cutters may be used successively, and kept in place and in adjustment. The advantages of such an arrangement will be readily appreciated by those who have had much experience with milling machine work.

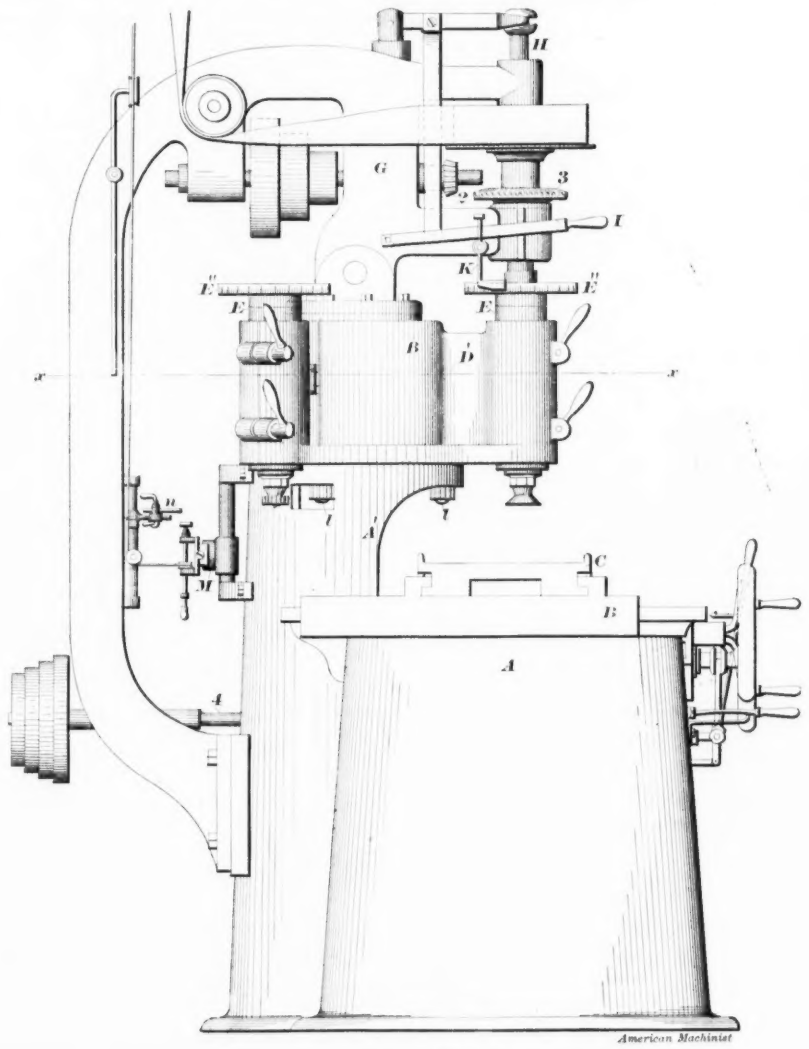


Fig. 1.

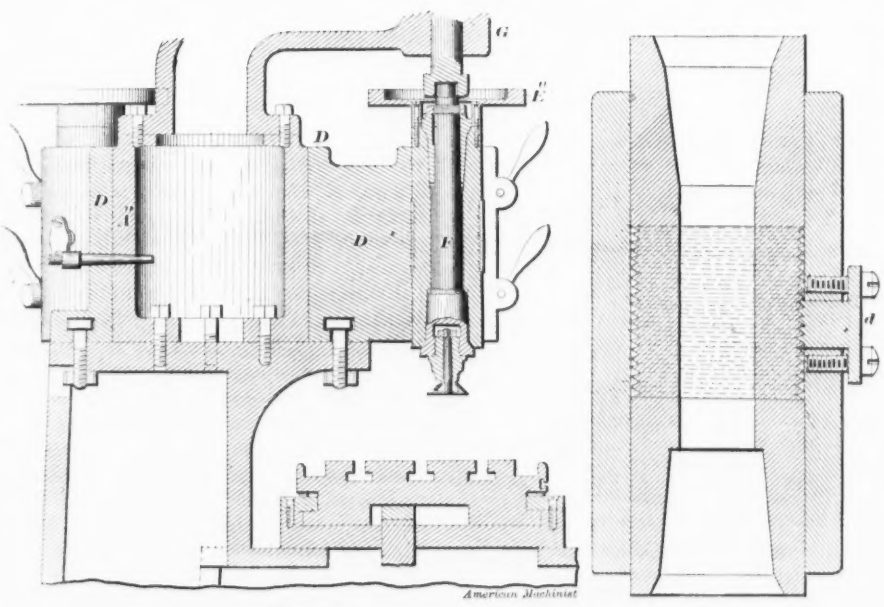


Fig. 2. *Fig. 3*

MULTIPLE-SPINDLE MILLING MACHINE.

Compressed Air at the World's Columbian Exposition.

Owing to the very low grade in Jackson Park, which prevents long gravity sewers, and to the sanitary objection against emptying the sewage into Lake Michigan, a system of sewers working under pressure and a sewage cleansing works were adopted.

The Stone ejector system was chosen as it appeared best suited to the conditions. This system will bear a brief description. The total territory to be drained is divided into sections. Each section drains by gravity sewers into the ejectors for that section. These ejectors are placed in pairs in pits under the ground, and are arranged to work alternately. The sewage flows into one ejector until it fills it; immediately, by automatic valves, the sewage is turned into the other ejector, and compressed air let into the first. The sewage is forced by the air into a high-pressure sewer. As soon as the ejector is emptied the valves turn automatically again, and the ejector is ready to receive sewage, when the other one is filled. Thus they alternate. Each may be emptied and filled once every minute, or it may be hours between the clicks of the valves.

From these pits the sewage is forced through cast-iron mains to its destination. At the exposition it will be forced to the sewage cleansing works located in the southeast corner of the park.

The air compressors are located in the power plant in Machinery Hall. There will be four of them from the Norwalk Iron Works Co. of the following sizes, one 26″x 30″, two 22″x24″, and one 16″x16″. These machines will be used for the sewage system only.

A Rand Drill Co. 22″ and 34″x48″, and an Ingersoll-Sargeant 18″ and 34″x48″, will supply compressed air for all other purposes by an independent system of piping. From Machinery Hall the ejector air pipes run in all directions, south to the stock exhibits, east to Agricultural Hall and the Casino, northeast to Manufactures, Fisheries and the Naval Exhibit (6,000 feet), and north to Mines, Transportation, Woman's, by the Art Galleries to the north end of the park—a distance of 7,000 feet.

There are in all between four and five miles of air pipes already laid in Jackson Park.

At Machinery Building the pipe is 10″ diameter, and it reduces in size as branches are taken off to 8″, 6″, 4″, 3″ and 2″. All 4″, 3″ and 2″ pipe is standard wrought-iron; all 6″ and above is cast-iron.

The pressures used in the different ejectors depend upon their distance from the Sewage Cleansing Works and upon the pipes.

At any pit it must be sufficient to overcome the friction head in the sewer pipe, and to raise the sewage 55 feet at the cleansing works.

At present the highest pressure used is 47 pounds. Reducing valves regulate the pressure at each pit.

The pipe is laid four feet below grade. No equalizing tank has been placed at the compressors, as the capacity of the air mains is sufficient to take care of any fluctuations due to the engines.

The pipes from the Ingersoll-Sargeant and the Rand compressors will supply air for running the elevators in the Transportation Building, and to operate the switch and signal towers in the railroad yards. They will also supply a considerable amount of power to the Mines Exhibit.

By far the most unique use yet made of compressed air at the World's Fair is in painting the large buildings. Paint is forced from a closed tank into a hose pipe by air pressure. At the same time compressed air is mixed with the paint immediately after it leaves the tank. The hose has a flattened nozzle which the paint leaves in a fan-shaped spray. All the painter has to do is to play away at the object he is painting, moving the nozzle slowly as the work is done. With this machine a man can do a remarkable amount of work. In one instance the painters stood fully 75 feet above the machines; this was in the Horticultural dome.

Doubtless compressed air will be used for many additional purposes before and during the Fair. It is hardly probable, however, that it will be used to any extent for power, as that will be supplied by electric motors.

Jackson Park, February 2d, 1893.

Cast of a Large Cylinder.

An exceptionally large cylinder, one of four, for the compound engines to be placed in a new Sound boat, now under course of construction, was successfully cast a few days ago at the works of the Wheeler Condenser and Engineering Company, Carteret, N. J. The cylinder will finish to 96 inches

in diameter; its length over all is 14 feet 6 inches, suitable for a stroke of 11 feet; its weight is about 25 tons.

Notes on Rope-driving—III.

By M. E.

From what has been said in the last article regarding the differential driving effect produced by slight differences in the diameters of the ropes, it will be abundantly clear that great care must be exercised in turning the several grooves in a rope-driving wheel or drum in order to insure the "pitch surfaces" and the shape of all the grooves being as nearly as possible alike. The importance of this is now fully recognized, and special tools, gauges and other appliances have been devised in order to insure accuracy in this respect.

Various methods of constructing large rope-driving drums are adopted by different makers, but with regard to the shape of the grooves and the disposition of the metal forming the rim, European practice is fairly uniform. In Fig. 6 is given a section of rim which may be taken as fairly representative; the depth of the groove D is, however, sometimes less, and occasionally slightly greater than that here given. The writer has constructed the following formulæ for the various dimensions indicated, and these give results agreeing very closely with the practice of the leading makers.

Let d = diameter of rope in inches; then the pitch of the ropes =

$P = 1.25\ d + 0.25$ inches, and the depth =

$D = 1.25\ d + 0.125$ inches, while the radius of the bottom of the groove =

$R = 0.375\ d$; also $W = d + 0.2$.

$T = 0.5\ d$; $Q = 0.33\ d + 0.1$; $S = d$.

$V = 0.25\ d$, and $X = \frac{5}{4}\ V$.

In Table I. is given the approximate dimensions obtained by these formulæ for the usual sizes of ropes used for main driving.

In ordinary small transmission wheels the rims are frequently made flat on the inside, as indicated by the broken lines, while for small powers an ordinary fly-wheel, with three or four grooves turned in its periphery, is employed. In large or even moderate sizes of rope-driving fly-wheels, however, the weight is usually excessive—far in excess of that required to insure steady running, and in these cases the rims are invariably hollowed out, as shown. This adds, perhaps, 8 or 10 per cent. to the cost of making, but it gives a more uniform section to the casting, and is generally advantageous. It might here be noted that the preference for rope-driving over gears for main driving in cotton spinning mills is in a measure due to the unavoidable use of the large and abnormally heavy rope drums, which, running at a high peripheral speed, insure that perfectly steady turning which is so essential to good spinning. That this is an advantage incidental to the use of this system of main driving is of no concern to the spinner, but as a rule it is a difficult task to convince him that as steady turning could be obtained by spur gear were it possible to employ an equally heavy wheel running at similarly high peripheral speed.

TABLE I.

DIMENSIONS OF GROOVES FOR ROPE-DRIVING.

Diameter of Rope = d	P	D	R	W	T	Q	V	S
in.	in.	in.	in.	in.	in.	in.	in.	in.
1	1 3/8	1 3/8	3/8	1 1/8	1/2	7/16	1/4	1
1 1/4	1 11/16	1 11/16	7/16	1 7/16	5/8	9/16	5/16	1 1/4
1 3/8	2	1 7/8	1/2	1 1/2	11/16	5/8	3/8	1 3/8
1 1/2	2 1/16	2	9/16	1 9/16	3/4	11/16	3/8	1 1/2
1 5/8	2 1/4	2 1/16	5/8	1 11/16	13/16	3/4	7/16	1 5/8
1 3/4	2 1/2	2 3/8	3/4	2	7/8	13/16	1/2	1 3/4
1 7/8	2 5/8	2 1/2	11/16	2 1/16	15/16	7/8	1/2	1 7/8
2	2 3/4	2 5/8	3/4	2 1/8	1	15/16	9/16	2

With regard to the construction of rope drums and pulleys various methods are adopted by different makers, and no very precise rules can be laid down as to the number of arms or segments. It may be said, however, that for diameters of less than about 9 feet, unless especially required to be split, the casting is made in one. The bosses or hubs are, however, sometimes split in three in order to relieve the contraction stress; rings are then shrunk on, as indicated in Fig. 17. Six arms are generally used for these wheels, but in some cases two sets of arms are employed. The usual run of wheels from 9 feet to 14 feet in diameter are cast in halves, six or eight arms being employed. Occasionally, however, narrow rope fly-wheels, of diameters up to 18 feet, are made in two pieces only, and with eight arms. When of moderate size wheels are frequently cast in one, but arranged so as to be readily split in two afterwards. For diameters of from 14 feet to 24 feet six or eight segments, and the same number of arms, is usual practice, although some makers will use ten segments for a 25-foot wheel. For drums from about 26 feet to 32 feet twelve segments and arms are generally used, while wheels of larger size are constructed in fourteen, sixteen or even more segments. The number of segments depends, to some extent, upon the width of the rope drum, but when a large number of ropes are used, necessitating a very wide drum, two wheels are frequently used, the two rims being coupled together by bolts passing through internal flanges, as shown in Fig. 11. A few examples of methods of building up rope drums are shown in Figs. 7 to 14, from which it will be seen that there is some difference of opinion with regard to the distribution of joints. When the rim segments are joined midway between the arms, as in Figs. 11, 12 and 14, the several connections are simplified to some extent, but all things considered the method shown in Figs. 7, 8, 9, 10 and 13 is decidedly preferable, and the best practice certainly favors this arrangement. It must be remembered that the circumferential velocity of these wheels is high—4,800 feet per minute—and with the joint midway between the arms there is a marked tendency for the joint to open under the influence of centrifugal force, the weight of the connecting flanges tending to increase the latter to some extent. With the rim joints at the junction with the arms, however, a rigid connection between adjacent arms is obtained, and the wheel is, structurally considered, a distinct improvement upon the other design.

It will be understood from the sketches that the built-up rope drum invariably consists of a large boss, hub, or center, which is sometimes between 8 and 9 feet in diameter, and which is carefully machined and bored to receive the arms. The general method adopted is to turn the ends of the arms slightly taper, to fit the correspondingly tapered hole in the wheel centers, and then to firmly secure the arms by folding cotters. Some makers, however, prefer to turn the arms quite parallel, and trust to a good fit being obtained to insure an absolutely rigid connection. Referring to the sketches, Fig. 7 represents an arrangement in which the I-section of the rim is diminished gradually from the points of attachment, as shown. This is, however, not now considered good practice, and has been discarded in favor of the rim of uniform depth (Fig. 8). Fig. 9 is a simple and fairly satisfactory arrangement of connecting the rim segments and arms together, but that shown in Fig. 10 is decidedly preferable, especially for wheels of large dimensions. Fig. 11 shows a portion of a double rope drum, being in fact two drums placed side by side, and united by bolts passing through return flanges F. In such combinations it is advisable to arrange matters so that the arms are staggered, thus causing the rim connections to break joint. Steel keys K are fitted as shown, in order to relieve the bolts of shearing stress. In this particular example the drum was 34 feet in diameter, 72 inches in total width of face, and grooved for 32 ropes of 1¾ inches diameter. The wheel centers were 7 feet 6 inches in diameter, and each of the 24 arms was secured by two steel cotters, 2 inches thick by 8 inches in depth. The total weight of the wheel was about 80 tons. (The arrangements shown in Figs. 12 and 13 do not call for any special remark, but are given as examples by leading makers.) Fig. 14 shows a somewhat unusual design, a wrought-iron bolt R being introduced to secure the arm to the rim and to the wheel center, this bolt receiving the tensile stress due to centrifugal force.

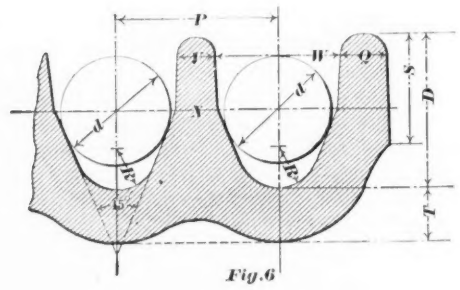


Fig. 6

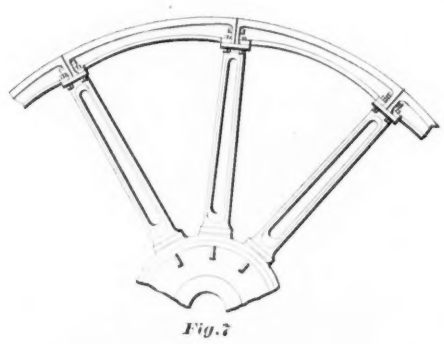


Fig. 7

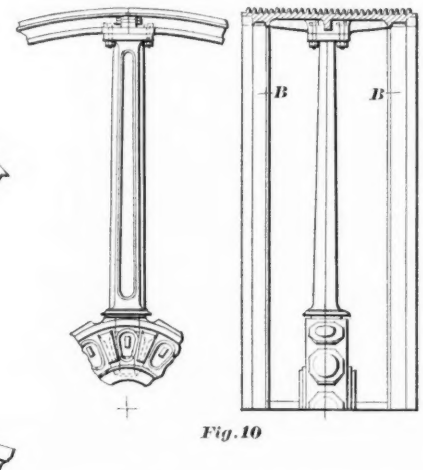


Fig. 10

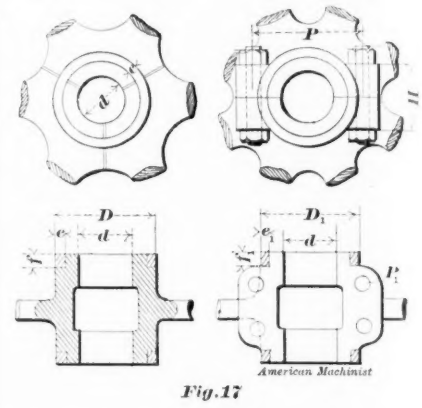


Fig. 17

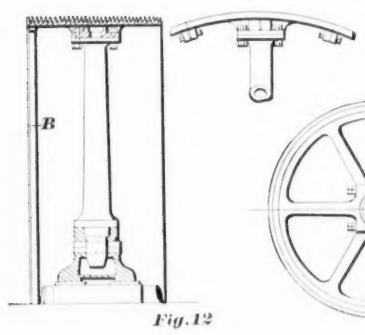


Fig. 12

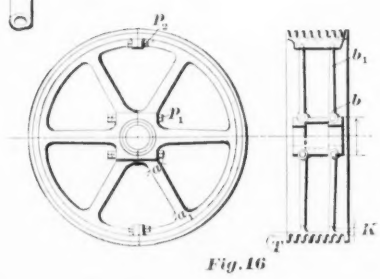


Fig. 16

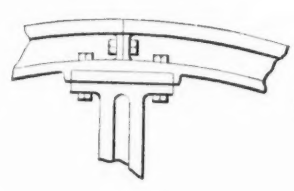
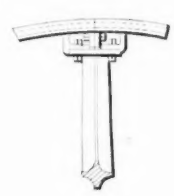


Fig. 8



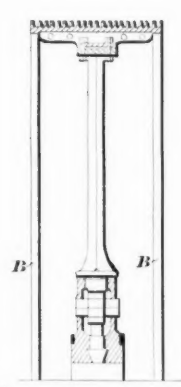


Fig. 13

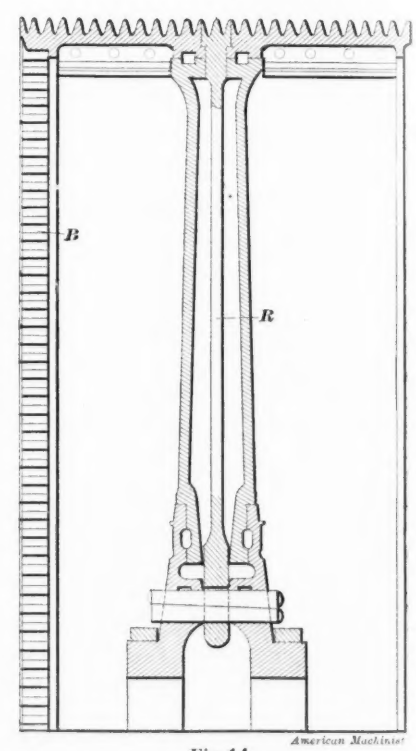


Fig. 14

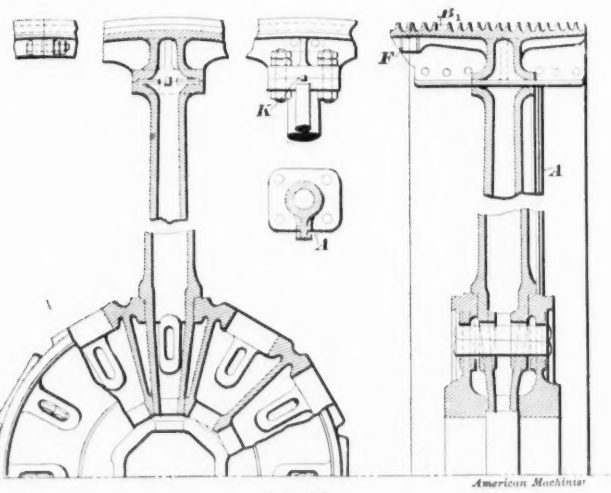


Fig. 11

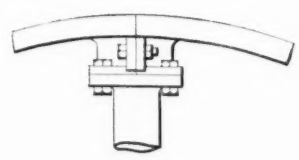


Fig. 9

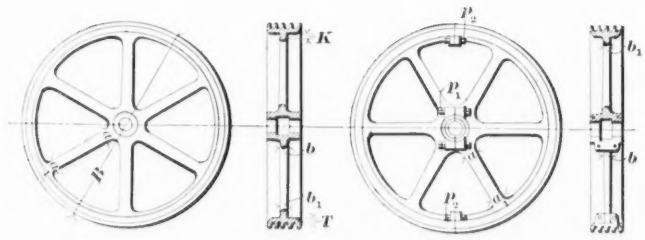


Fig. 15

As will be seen, arms of various sections are employed, and although the round or pipe arm is most generally adopted, many makers of repute adhere to those of cruciform or H-section. The several joints should be carefully machined, and great care should be taken to insure a good fit for the bolts connecting the arms and rim segments, and they should invariably be fitted with check nuts, though this latter precaution is sometimes neglected. Barring racks are generally provided on the inside of the wheel rims, as indicated by *B B*, but occasionally they are placed on the outer periphery, as is shown at *B*, Fig. 11. The former plan is generally preferable, as it economizes the width of the drum—always an important consideration. To prevent fan action of the arms all large wheels are securely boarded up, provision often being made for this, as shown at *A*, Fig. 11.

Table II. gives dimensions of light rope wheels for secondary driving, with a single set of (oval) arms, Fig. 15, while Table III. gives similar dimensions for wheels with two sets of arms (Fig. 16). Tables IV. and V. give dimensions of hooped hubs or bosses for these wheels (Fig. 17). None of these are suitable for rope pulleys intended to act as fly-wheels.

TABLE II.

LIGHT ROPE PULLEYS—1¾-INCH ROPE—ONE SET OF ARMS.

Diam	No. of Arms.	*T*	*K*	For 1 or 2 Ropes.			
				a	a_1	*b*	b_1
ft. in.		in.	in.	in.	in.	in.	in.
3 6	6	9/16	1 7/8	2 5/8	2 1/4	1 1/8	1
4 0	6	5/8	2	3	2 1/2	1 1/4	1 1/8
5 0	6	5/8	2 1/8	3 3/8	2 5/8	1 3/8	1 1/8
6 0	6	5/8	2 3/8	3 5/8	2 3/4	1 1/2	1 1/4
7 0	6	5/8	2 3/8	3 7/8	2 7/8	1 5/8	1 3/8
8 0	8	11/16	2 5/8	4 1/8	2 7/8	1 5/8	1 1/4
10 0	8	3/4	2 7/8	4 1/2	3	1 7/8	1 3/8
12 0	8	13/16	3	4 3/4	3 1/8	2	1 3/8

Diam	No. of Arms.	*T*	*K*	For 3 or 4 Ropes.			
				a	a_1	*b*	b_1
ft. in.		in.	in.	in.	in.	in.	in.
3 6	6	9/16	1 7/8	3 1/4	2 5/8	1 5/8	1 3/8
4 0	6	5/8	2	3 3/8	2 7/8	1 3/4	1 1/2
5 0	6	5/8	2 1/8	3 3/4	3	1 7/8	1 1/2
6 0	6	5/8	2 3/8	4	3 1/4	2	1 5/8
7 0	6	5/8	2 3/8	4 1/4	3 1/4	2 1/4	1 5/8
8 0	8	11/16	2 5/8	4 3/8	3 1/4	2 1/4	1 5/8
10 0	8	3/4	2 7/8	4 7/8	3 3/8	2 1/2	1 3/4
12 0	8	13/16	3	5 1/4	3 5/8	2 3/4	1 7/8

Diam	No. of Arms.	*T*	*K*	For 5 or 6 Ropes.			
				a	a_1	*b*	b_1
ft. in.		in.	in.	in.	in.	in.	in.
3 6	6	9/16	1 7/8	3 1/4	2 5/8	2	1 3/8
4 0	6	5/8	2	3 1/2	3	2 1/4	1 3/4
5 0	6	5/8	2 1/8	3 7/8	3 1/4	2 3/8	2
6 0	6	5/8	2 3/8	4 1/8	3 3/8	2 3/8	2 1/4
7 0	6	5/8	2 3/8	4 3/8	3 5/8	2 3/4	2 1/4
8 0	8	11/16	2 5/8	4 3/8	3 5/8	2 3/4	2 1/8
10 0	8	3/4	2 7/8	5	3 5/8	3 1/8	2 1/4
12 0	8	13/16	3	5 1/2	3 7/8	3 1/4	2 3/8

TABLE III.

LIGHT ROPE PULLEYS—1¾-INCH ROPE—TWO SETS OF ARMS.

Diam	No. of Arms.	*T*	*K*	For 5 or 6 Ropes.			
				a	a_1	*b*	b_1
ft. in.		in.	in.	in.	in.	in.	in.
3 6	6	9/16	1 7/8	3	2 1/2	1 1/4	1 1/8
4 0	6	5/8	2 1/8	3 1/4	2 5/8	1 3/8	1 1/4
5 0	6	5/8	2 1/8	3 3/8	2 7/8	1 5/8	1 1/4
6 0	6	5/8	2 3/8	4	3 1/4	1 3/4	1 3/8
7 0	6	5/8	2 3/8	4 1/4	3 1/4	1 7/8	1 1/2
8 0	8	11/16	2 5/8	4 1/4	3 1/2	1 7/8	1 3/8
10 0	8	3/4	2 7/8	4 3/4	3 3/8	2 1/8	1 1/2
12 0	8	13/16	3	5 1/4	3 3/8	2 1/4	1 5/8

Diam	No. of Arms.	*T*	*K*	For 7 or 8 Ropes.			
				a	a_1	*b*	b_1
ft in.		in.	in.	in.	in.	in.	in.
3 6	6	9/16	1 7/8	3 1/4	2 3/4	1 5/8	1 1/8
4 0	6	5/8	2 1/8	3 1/2	2 7/8	1 1/2	1 1/4
5 0	6	5/8	2 1/8	3 7/8	3 1/8	1 5/8	1 3/8
6 0	6	5/8	2 3/8	4 1/8	3 1/4	1 3/4	1 3/8
7 0	6	5/8	2 3/8	4 1/2	3 1/2	1 7/8	1 1/2
8 0	8	11/16	2 5/8	4 1/2	3 5/8	1 7/8	1 1/2
10 0	8	3/4	2 7/8	5 1/8	3 5/8	2 1/8	1 5/8
12 0	8	13/16	3	5 5/8	3 7/8	2 3/8	1 3/4

Diam	No. of Arms.	*T*	*K*	For 9 or 10 Ropes.			
				a	a_1	*b*	b_1
ft. in.		in.	in.	in.	in.	in.	in.
3 6	6	9/16	1 7/8	3 1/2	3	1 1/2	1 1/4
4 0	6	5/8	2 1/8	3 3/4	3 1/4	1 5/8	1 3/8
5 0	6	5/8	2 1/8	4 1/8	3 3/8	1 3/4	1 1/2
6 0	6	5/8	2 3/8	4 3/8	3 1/2	1 7/8	1 1/4
7 0	6	5/8	2 3/8	4 3/4	3 5/8	2	1 5/8
8 0	8	11/16	2 5/8	4 3/4	3 1/4	2	1 1/4
10 0	8	3/4	2 7/8	5 1/8	3 5/8	2 1/4	1 5/8
12 0	8	13/16	3	6	4 1/4	2 1/4	1 7/8

TABLE IV.

DIMENSIONS OF HOOPED PULLEY BOSSES—LIGHT ROPE PULLEYS.

d	*D*	*e*	*f*	*d*	*D*	*e*	*f*
in	in.	in.	in.	in.	in.	in.	in
4	7	1/2	3/8	7	12	3/8	1 3/8
4 1/2	8	1/2	1	8	13 1/2	1	1 5/8
5	9	5/8	1 1/4	9	15	1	1 5/8
5 1/2	9 3/4	5/8	1 1/8	10	16 1/2	1 1/8	1 7/8
6	10 1/2	3/4	1 1/4	12	20	1 1/4	2 1/8

TABLE V.

DIMENSIONS OF SPLIT PULLEY BOSSES—LIGHT ROPE PULLEYS.

d	D_1	*P*	*H*	e_1	f_1	p_1	p_2	No. of Bolts on Each Side.
in	in.	in.	in.	in.	in.	in	in.	
5	9 3/4	10 1/2	6 1/4	1	1 3/8	1 1/2	1	4
5 1/2	10 1/2	11 1/4	7	1	1 3/8	1 1/2	1 1/8	4
6	11	12	8	1	1 3/8	1 1/2	1 1/4	4
7	12 1/2	13 1/2	9	1 1/8	1 1/2	1 1/2	1 3/8	4
8	14 1/4	15	9 1/2	1 1/4	1 3/4	1 5/8	1 1/2	4
9	16	17 1/2	10 1/4	1 3/8	1 7/8	1 5/8	1 1/2	6
10	17 1/2	19	11	1 3/4	2	1 3/4	1 1/4	6
12	20 1/2	22	12 1/2	1 1/2	2 3/8	2	1 1/2	6

Development of the Micrometer Caliper.

It will be remembered that in our issue of Dec. 15, 1892, we published some account of the development of the now almost universal micrometer caliper. In that article sketches of some prototypes of the present tool were given, among them one patented by "citizen" Palmer of Paris, in 1848. Regarding this, we are enabled to print the following letter from the Paris representatives of the B. & S. Manufacturing Company:

PARIS, 6th January, 1893.

BROWN & SHARPE MFG. CO., Providence, R. I.

GENTLEMEN—In reading over the AMERICAN MACHINIST dated 15th December, we see that you seem to have a controversy or polemic with the Bridgeport Brass Co., about the origin of the micrometer. Mr. Mandon, having some researches to make at the Patent Office, happened to come across the original patent delivered to Palmer on the 7th of November, 1848, and thought it would interest you to hear about it. We beg to inclose copy of the patent granted to Palmer in 1848, and also copy of the designs attached to the patent. If you think it necessary, we could send at your request a copy of the full description of the principle.

Yours most respectfully,
FENWICK FRERES & CO.

The copy of the patent we placed in the hands of W. D. Forbes for translation, which is as follows:

MINISTER OF AGRICULTURE AND COMMERCE.

PATENT OF AN INVENTION WITHOUT GOVERNMENTAL GUARANTEE.

To the Minister of Agriculture and Commerce.

In accordance with the law of July 5, 1844.

In accordance with this law, on September 7th, 1848, at 3 o'clock and (5) minutes, a citizen named Palmer demanded of the Secretary of the Department of the Seine a patent for 15 years on a screw caliper with circular vernier. In consequence of the regularity of this demand, it is decreed as follows:

ARTICLE FIRST.

To Jean Laurent Palmer, a machinist of Paris, 16 Rue Montmorency, on the 7th day of September, 1848, is guaranteed a patent for (15) years on a screw caliper with circular vernier, the same being guaranteed to him at his own risk and peril without any examination as to its value or novelty, or to the fidelity or exactness of this description.

ARTICLE SECOND.

This decree constitutes a title to this citizen Palmer for his invention, and to this decree is affixed duplicate certificates of the drawings and descriptions deposited by him in support of his original statements, which are hereby duly established.

THE MINISTER OF AGRICULTURE.
Paris, Sept. 7, 1848.

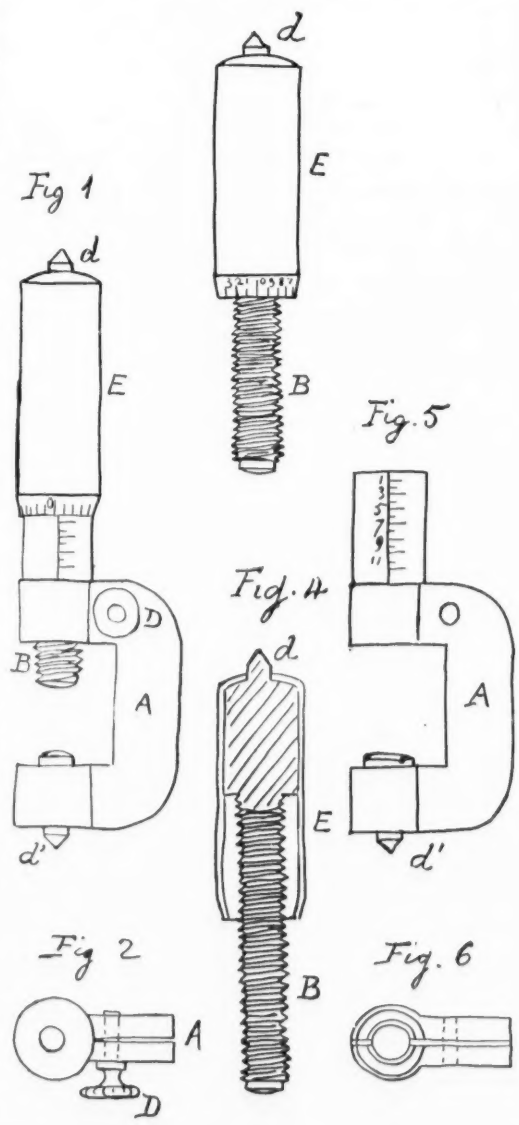
With the translation, Mr. Forbes sends the following letter and comment:

HOBOKEN, N. J., Jan. 24, 1893.

Your favor of the 20th is just at hand inclosing a copy of a letter to the Brown & Sharpe Mfg. Co., from Messrs. Fenwick Bros. & Co., Paris; together with a French certificate of a patent issued to Jean Laurent Palmer, for a screw caliper with circular vernier. The inclosed liberal translation of this document explains itself.

After looking at the date of the Palmer patent, the production in Bridgeport, 1867, of a micrometer is proved beyond doubt to have been anticipated.

I send you herewith a sketch of the Bridgeport tool, which you will see was by no means as far advanced toward perfection as that of Palmer. I cannot remember whether I made this sketch from the micrometer owned by Mr. Wilmot, or by Mr. Law, but I think it was the property of the former.* In the blue-prints of the Palmer micrometer the little pin in the back end of the screw sleeve and abutment screw shows that it was intended for an inside micrometer, and it impresses me as being very practical. It is not surprising to me to find out that what we consider modern is really ancient.



[* Sketch referred to is precisely like Fig. 3 in the article published Dec. 15, and is not therefore reproduced.—ED.]

I was particularly astonished with this in making some researches in Europe, not long ago, in regard to small arms and machine guns. I found almost everything now considered new, to be in more or less of a crude state in arms dating back years ago, and in some cases centuries.

The one thing, however, which seems to absolutely belong to our time, was the invention or conception by Dr. Gatling of loading while firing, and which, of course, gives a continuous fire.

The multi-barrel gun I found had been made centuries ago by Eastern people. I tried a micrometer on the barrels of one of these guns. They seemed to vary almost nothing in their outside diameter.

Whoever placed the micrometer on the American market deserves to share honors with its inventor, and I feel that the AMERICAN MACHINIST does a very good work in placing before its readers any information which will throw light on the origin of so useful a tool. W. D. FORBES.

Though it would be interesting, perhaps, to read Palmer's description of his micrometer, it is not necessary so long as we have the accompanying sketches, which show its construction clearly, and that as conceived by him the tool was well developed, and possessed all the most essential features of the micrometers made at this time. We have left all the original letters of reference on the drawings, as these evidently show the parts to which he called especial attention in his description. It will be noticed that the frame or bow appears to have been split longitudinally for some distance, and a clamping screw used, which may have been for clamping the screw at any desired setting, or for taking up wear. Though the graduations are referred to in the patent as being a circular vernier, we do not think this is a correct use of the term, the drawings indicating that the vernier principle is not made use of. The sketches are reproduced as nearly as possible in the engravings, no attempt having been made to improve them.

Making Cross Tubes.

The cross tubes of boilers are made of iron or of steel. They are formed of plate rolled to the tubular shape and welded, and the flanges are hammered over from the solid. I will describe the method of their manufacture in detail.

After the plate for the tube has been cut off and rolled it has the appearance of Fig. 1, *A*, and is ready to be welded. Now it is not so practicable to make a lap weld as a butt weld in long tubes. First, the necessary preliminary upsetting cannot be readily performed. Neither can so good a joint, or one of so even a thickness, be made by means of a lap, as of a butt weld. Further, it is more difficult to weld steel to steel than to weld iron to steel. So the plan shown in Figs. 2 and 3 is adopted, the first being used for the tubes of small boilers, which are not so weighty but that a man can handle them; the second is for larger tubes, the weight of which has to be sustained by the smith's crane.

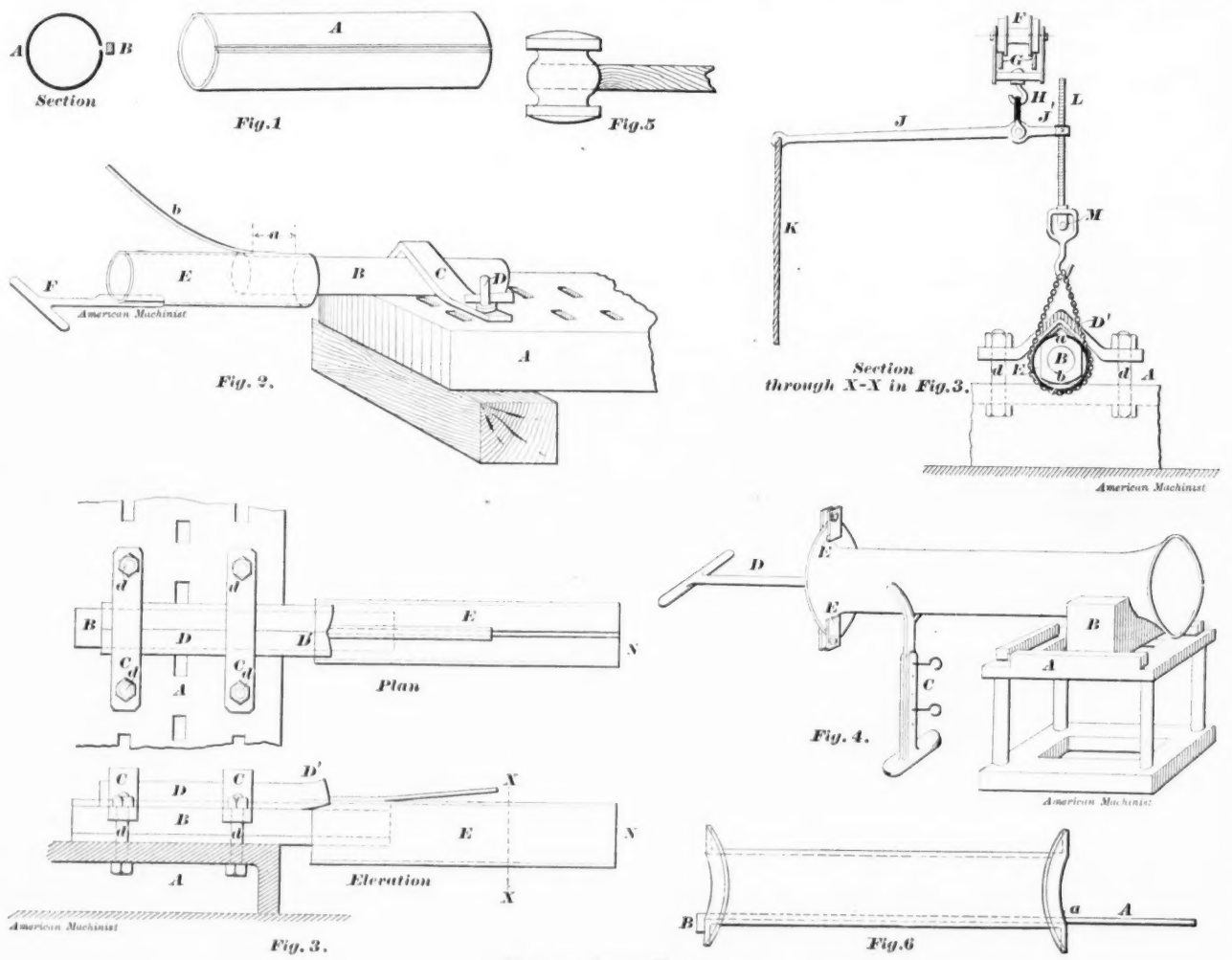
The tube is bent round until the edges are within about ½" of each other at the narrowest portion, Fig. 1. Those edges are then welded by the intercalation of a strip of rectangular iron bar *B* between them. The edges of the bar are not beveled.

If the tube *A* is of "glut" or steel the "stick-in-piece" *B* is of iron, for this reason: It is impossible to raise steel to so high a temperature as iron without risk of its becoming burned. If the stick-in-piece were of steel it would too soon lose the heat necessary for welding. Being of iron it is raised to a much fuller heat—that of dazzling whiteness—and thus it retains a welding heat long enough to allow the smith to unite the edges together. In reference to the use of iron with steel boiler makers believe that the nature of the steel is largely communicated to the narrow strip of iron lying between it. Anyhow the work is much more reliable than as if a strip of steel were imperfectly welded between steel.

In order to make a perfect weld the work is done in successive lengths, each of about 6″ or 8″. Each welding is made to overlap the previous weld by about two or three inches; that is, two or three inches of the length last welded will be heated again with the next consecutive weld.

The appliances used during the welding of the tube are shown in Figs. 2 and 3. *A* is a common leveling block, which being massive, is very steady. Upon it a kind of mandrel *B* is clamped. For small tubes this will be a rod of wrought-iron, as in Fig. 2; for larger ones, a stout hollow cylindrical casting, as in Fig. 3. For small mandrels as shown in Fig. 2, a single strap *C* is used for holding it upon the leveling block. The strap is of wrought-iron, and is secured with two cotter bolts *D* inserted in any two convenient holes in the block. Upon the projecting end of *B* the tube *E* is welded. It is held up with the pronged or fork-like handle *F*, the width of the opening of the fork being the same as the thickness of the plate in the cross tube.

All being ready the open edges of the tube are laid lowermost in the fire, taking care that they do not come into actual contact with the coke. That length of tube, therefore, which has to be welded at one heat is blocked up over a hollow fire, and the blast put on. The rectangular stick-in-strip is heated at an adjoining forge by a striker. The boiler maker from time to time tries the heat of the tube with the point of a poker, and judges partly by color, but chiefly by the soft and pasty condition of the metal under the point of the poker, when the welding heat is reached. Two or three times powdered borax is strewn over the steel in the fire. When ready he draws it out, his attendant brings the bar similarly heated, and lays it over the narrow opening. At the instant of commencing the weld the relations of the edges and of the bar are those shown in Fig. 1 (section). The bar and the tube being at the welding heat a very few blows suffice to drive the bar into the edges of the tube.



MAKING CROSS TUBES.

In Fig. 2 the length *a* represents about the length in proportion to the total length of the tube that is welded at one heat. The free end of the bar *b* is lifted up and cut off to be re-heated for the next piece of weld. Generally the practice is to weld the central lengths first, and the end lengths subsequently.

As soon as the weld has been made, the surface is smoothed over with a hollow tool and sledge, and the tube is returned to the fire for the next heat.

In Fig. 3 the appliance used for heavy cross tubes is shown. The mandrel *B* is of cast-iron, and its two faces, *a* and *b*, are of different curvatures to suit tubes of different radii. This is clamped down upon the block *A* with two straps *C C*, held with pins and cotters, or bolts *d*. The clamps do not press directly upon the bar, but upon the edge of a strip of angle-iron *D*, interposed between them and the bar. The angle-iron is opened or set out a little at the end *D'*. The object of this is to prevent the tube *E* from becoming jerked upwards and misplaced by the force of the blows given during welding. One end of the tube being slipped underneath, the set-up portion of the angle cannot jump upwards.

The tube is further supported at about the center by the forge crane. The crane also swings the tube to and from the fire.

From the little jinny *F* running along the horizontal jib *G* of the smith's crane, a hook *H* is suspended.

To this hook is slung a pivot and lever *J*, having arms of unequal lengths. From the end of the short arm *J* the tube *E* is slung, and to the end of the long arm a chain or rope *K* is attached. The workman seizing hold of the latter is able to exercise complete and rapid control of the work, lifting and lowering it instantly. This apparatus, in conjunction with the slewing of the crane jib upon its top and bottom pivots, enables the work to be moved about as quickly as the workmen themselves can move. The preliminary adjustment for height is made with the screw *L*, a podger being inserted in the hole *M*.

To enable the work to be turned about on its axis during the process of welding and of finishing off subsequently, a striker holds the pee end *N* in a fork with a cross handle like *F* in Fig. 2. The fork slips over the end of the tube with sufficient friction to permit of its movement by the striker.

After the joint has been welded, and the surfaces smoothed and finished the ends are flanged thus:

It is necessary to support the tube level upon a firm block, and to hold it in such a way that it shall resist the force of the hammering necessary to beat out the flanges. The following is a suitable method:

In Fig. 4 *A* is the "swage stand," an appliance common to all forges.

Upon it and within the strips any suitable cast-iron block *B* is laid. This one *B* fits between the strips and is curved to the radius of the tube. The tube is kept in a horizontal position by being allowed to rest upon the adjustable stand *C*. The tube is rotated and prevented from being driven backward by the force of the hammer blows by a forked handle similar to *F* in Fig. 2. This handle is not shown in Fig. 4, the illustration representing the work after one end has been flanged.

The end of the tube that has to be flanged is brought to as high a temperature as it will safely stand—about a welding heat—laid upon the block *B* and stand in the position shown in the figure, and very gradually and cautiously the end is opened out with broad hammers of the form in Fig. 5. The boiler maker stands on the right-hand side, and a striker on the left, and strike alternate blows, while another striker slowly rotates the tube with the pronged handle. The blows are delivered approximately at an angle of about 45° with the axis of the tube. The effect is first to spread out or bell-mouth the tube slightly, as in Fig. 4. By the time about as much bell-mouthing as that shown in the figure has been done, though the end will still be at a low blood-red heat, it will be unsafe to do any more work upon it without running the risk of cracking it. It is therefore put back into the fire and re-heated, and another spell of work done, increasing the bell-mouth. This may be repeated three or four times, dependent on the quality of the material and the smartness of the men. When the bell-mouthing has passed an angle of about 45° then the flange is soon turned into the angle of 90° with wooden mallets, substituted for the iron hammers hitherto used.

It is finished upon a cast-iron block, having its face of the same curvature as required for the flange.

The flange at the other end of the tube is formed in a precisely similar manner. To grip the flange already made during the formation of the second, an appliance like that shown at the left hand of Fig. 4 is used.

The length of the tube is gauged while the second flange is being formed with the bent rod used as shown in Fig. 6. I. H.

English Locomotives and Railway Management.

BY W. H. BOOTH.

I see that Mr. Crane has something excellent under this heading, but I must correct just one or two little items. When I asked "what surface contact has to do with adhesion?" this did not imply that I had not heard of Mr. Swinerton, of Boston, but rather that I had heard of him, and if Mr. Swinerton's wheel does give greater adhesion it is because it is rough, for such narrow facets as he makes give very little departure from the true circle, and I say, moreover, that, in my opinion, even if a wheel had four square inches of rail contact all the time the adhesion would be no greater. Then as to six-wheel trucks. My reply to this is that the bar frame of the locomotive is older in England than almost any other detail except the boiler or cylinder, but it would puzzle Mr. Crane to find one. Age is no proof of numbers, and when I wrote of six-wheeled trucks I was referring to usual practice. In what Mr. Crane says as to the differences of conditions in America and England I agree entirely with him, and have expressed myself in the columns of the AMERICAN MACHINIST in almost the same words, save and excepting his appreciative references to the appearance of this island, which needs to be seen to be believed in, but I don't think Mr. Crane sufficiently recognizes that what I have all along advocated is the use of single engines of appropriate dimensions on just those American railroads which do approach English conditions, and that I have sent a week or two ago a drawing with weights and dimensions of such an engine which has done a duty hitherto not surpassed even by the No. 385 of the Empire State. Of the ordinary American traffic I do not pretend to speak. Its needs have been met by the American locomotive man, but when we come to exceptional traffic and find that for high speeds an American train requires an engine so very much heavier than trains of equal weight require in England, at equal speeds, we must see that there is a cause. The weight of cars has nothing to do with the matter, for we are dealing with train weight irrespective of cars, and this it is that leads me to conclude that were the six-wheeled truck more common, the traction would be reduced both by reason of better bearing surface, and better distribution of weight on the rail.

Now if No. 385 has small wheels I do not want Mr. Crane to stop saying so, but even if it has run high speeds and has small wheels, this is no proof it is the best engine for high speeds, and indeed if it is the best, as Mr. Crane argues, what is the meaning of seven-foot wheels now made and making for fast traffic by American engineers? It means simply that before Mr. Crane is convinced that wheels should be proportioned somewhat to speed, he will find that they have actually become so and are running the Empire State and other fast trains, and we may equally look forward to the use of the single pair of drivers, heavier rails, and better load distribution.

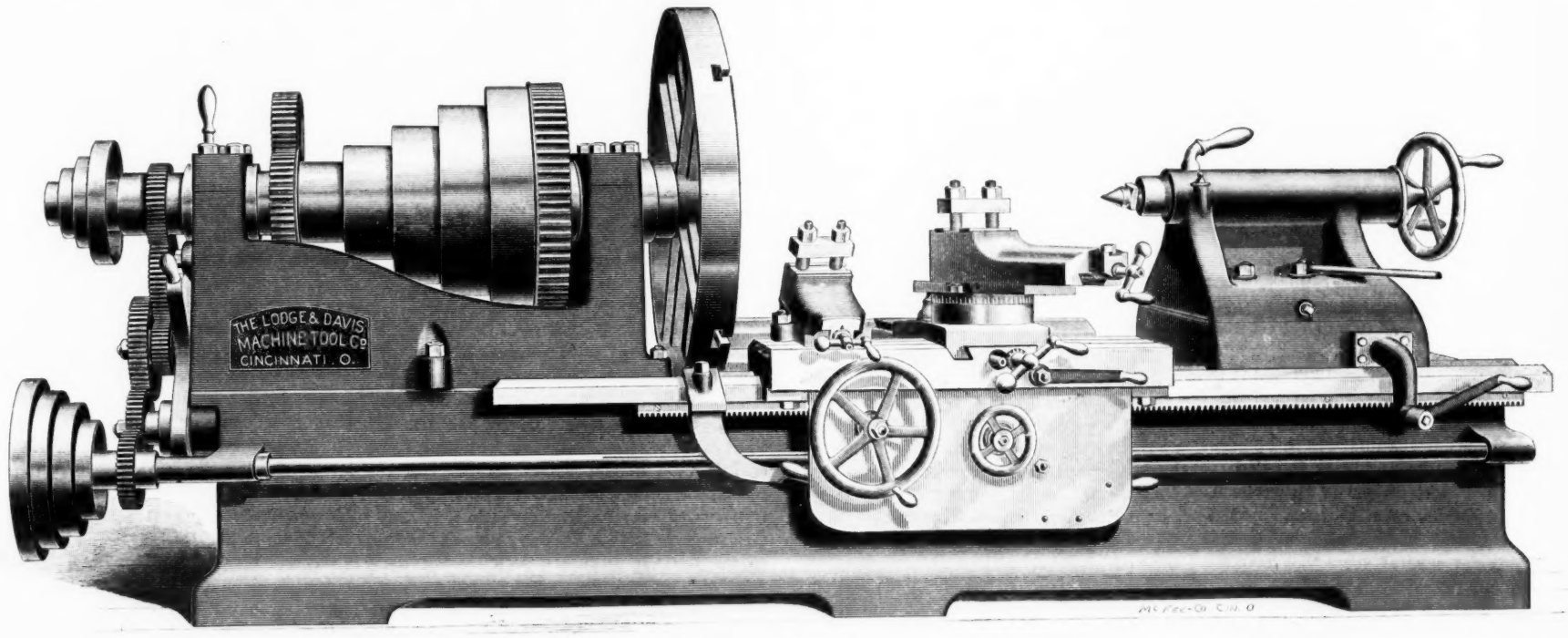
I do not look forward to the use of lighter cars as a whole, but with the above improvements engines like the N. E. single, recently illustrated, would pull the present American trains, for they pull heavier trains here. In fact it is a mistake to think that the comparative lightness of English freight trains and freight engines is any measure of the passenger traffic engines and trains. English freight engines *are* very small and light. They have six coupled wheels only, and these are only as a rule 48″ or 50″ diameter, and the total weight is about three-fourths that of a passenger locomotive, and they will run if allowed to do so sixty miles an hour, but rarely exceed forty with freight trains. We know what small wheels will do in the way of speed quite as well as other people know it, but we also know what large wheels can do, and we know this by actual practice. It is not a matter of theory or opinion, but fact.

I see that Mr. Pullman has been reported as saying that the result of a recent English accident proves that heavy cars are the safest

in which to ride, and the reporters of the daily papers here have been writing in the same strain. Their text has been simply that in the Thirsk accident a Pullman car was not broken up and its occupants were unhurt. None of the reporters noted the fact that between the Pullman car and the engine were two other cars of lighter build offering a structure from sixty to eighty feet in length, probably of yielding material, through which the Pullman car had to break its way before it stopped Of course what was really proved was the advisability of a gradual stop.

The engine was piled up on the rear of the freight train, and the rear of the passenger train headed by the heavy Pullman expended its energy on the unfortunate two leading cars. Had these also been Pullmans it is probable that the escaping third car would have been badly wrecked. Is it not a mistake to suppose that either a light or a heavy car has any special element of safety? In a train of light cars the destructive energy is less, and so is the strength to resist it, In the heavy car the destructive energy increases with the increased weight. The teaching of this accident is that two old weak cars should head every train and contain no passengers, and it is quite customary here to exclude passengers from the front end of the car next the tender. In the south-east of England the climate is favorable to car life. On the S. E. Ry. there are cars which cannot be less than fifty years old, standing or rather running proofs of the excellence of material and workmanship put into them, and of the opposite qualities of the present imbecile management of the lines in this unfortunate corner. When Mr. Crane comes to see me, as I hope he will the next time he is over, I will show him specimens of car architecture in this traveling museum which will open his eyes in one direction anyhow, and give him points that would enable him to far outstrip Mr. Arthur in caustic remarks without, too, sacrificing veracity, except so far as that nothing he could say would come down to the actual facts of the disgraceful condition of three of our roads; but the funny thing is that a paragraph appeared in an American paper a few days ago speaking of "the South Eastern, the Chatham and Dover, and other important railways," and this, too, was written by an Englishman who knew all the time that the lines he named were unparalleled for badness. When my own countrymen allow themselves such license we need hardly blame the American, who on a visit to France is almost certain to pass over one or other of our three worst lines, if he makes up a sweeping generalization from a single seventy miles journey. Just at present we are all feeling more than usually annoyed with all our railroads who have, in direct contravention of the intentions of Parliament, put up freight rates from 30 to 200 per cent. This is having a very serious effect on, more especially, agriculture, already overburdened by unjust land laws. The last act to regulate freight charges contains provisions which will be put into force if the railroads do not climb down from their untenable position.

In the meantime a great impetus has been given to the coasting and river steamers, and the event is proving a source of revenue all over the country to the people on the long-neglected highways, and it is pleasant to note a very sudden and serious shrinkage of railway earnings since the 1st of January when the new rates commenced, a shrinkage which will tend to show stockholders how small a proportion of intelligence it has pleased providence to distribute amongst directors. I do not think that American rates could be possible here under even ideal management, for American rates as quoted so low are for bulk, and hitherto English rates have not, considering the fact that the railroads collect and deliver, been heavier than American rates for similar parcels, but now there is no doubt about it, though it looks likely not to last. In the meantime the railroads are diverting all the traffic they can into other channels, and when the rates are again lowered the new channels will remain open, a continued loss to the railroads. The saving fact is that the Board of Trade has powers under the act to fix its own rates and embody them in a bill to Parliament, and a persistence in the present charges will force this result, and end in a general election fought on the question of railway rates, the political divisions being *pro tem* abolished.



THIRTY-SIX-INCH ENGINE LATHE.

Thirty-six-inch Engine Lathe.

We present with this an illustration of a heavy thirty-six-inch engine lathe built by the Lodge & Davis Machine Tool Co., Cincinnati, O.

In its general features and characteristics this lathe is essentially the same as those of smaller sizes built by the same company, and which are familiar to our readers.

It will be noticed that the bed is of great depth and massiveness, that the head-stock is unusually long and bolted to the bed at three points in its length; that the feed rod may be driven either by belt or gears, by which latter a feed ranging from $\frac{1}{8}''$ to $\frac{1}{100}''$ may be obtained either in the carriage or cross-feed, the compound rest being also fed automatically at any angle. The lead screw is inside the bed, as near as possible to the resistance, and is engaged by an open and shut nut, operated from the front of the carriage.

The spindles are of steel, the live spindle having ground bearings running in composition boxes which are readily adjustable for wear. Feeds are reversed at the carriage, the gearing in the apron being so arranged that no harm can come of the two feeds being thrown in simultaneously; so that the gearing can be thrown out when cutting screws, and with an automatic stop for the carriage.

The apron is attached to the carriage in such a way as to further stiffen it, and the slides attached to the lead screw nut are fitted to the solid metal of the carriage, so that they do not depend upon bolts or screws for their rigidity.

The foot-stock, though very heavy, is readily moved along the bed by the pinion and crank shown

The general proportions of the lathe are well shown by the engraving, and it is made with any desired length of bed.

LETTERS FROM PRACTICAL MEN.

Boiler Treatment.

Editor American Machinist:

Perhaps no patient under medical treatment suffers more, and is more patient withal under the maltreatment it suffers, than the steam boiler. Ill-fed, overworked, and exposed to extremes of temperature, it is little wonder if it becomes sickly. Congestion is the source of all boiler maladies, and when it becomes necessary to prescribe for it the remedies that are offered are bewildering. Nearly all of these remedies are composed of unknown drugs, and being chemical in their action are presumably injurious.

At the risk of being called a boiler doctor I beg leave to suggest a mechanical cure that is at least not injurious, and may be a specific for all boiler diseases. A pound or two of fine plumbago introduced into the boiler will lubricate the precipitated particles so they will not stick to form a scale, and existing scale becomes slippery and loses its grip. New boilers treated in this way will probably never acquire a scale, and may be less liable to corrosion.

This seems to be a commonsensical expedient, and as far as it has been tried it is believed to be a success.

Engineers are all invited to participate in this experiment and report to the AMERICAN MACHINIST. C. W. CRAWFORD.

Cam Rollers.

Editor American Machinist:

In reply to the query of Mr. Gribben, would say that in the case I had so much trouble with, the stud was $\frac{5}{8}''$ and roller 1" diameter, cam 14", and with such a large cam and small roller the fact that the roller was cylindrical could hardly be a serious objection; the roller was $\frac{5}{8}''$ long. The gist of the whole thing appears to me to be not so much the shape of the roller as the distressing tendency to stick, be the shape what it may, and the means to overcome it. The real reason it sticks is, in my opinion, the great difference in contact surfaces while working—on the outside it touches on but a single line, the length of the roller, while on the inside the surface in contact is never less than the diameter of roller; hence the *stick*—"there's the rub," and seems to me the only remedy lies in the direction of a larger roller, or some anti-friction stud bearing, both of which will, of course, have to be governed by other conditions, which make ideal proportions impossible.

H. HARDINGE.

Adoption of Standard Sizes of Keys—Long and Short Keys.

Editor American Machinist:

In your valuable paper of January the 5th I find several tables of sizes of keys for shafts, and notice there is a difference in some instances from a table which was made by me some time ago and adopted in my works.

As there is no regular standard in use it may be well to discuss the matter more fully, so that shafting manufacturers may adopt a standard table of keys, which will, undoubtedly, be of much value, the same as the adoption of standard diameters of shafts that the manufacturers now use.

I will first state that I approve of the taper $\frac{3}{16}''$ per foot.

Regarding the width and thickness I differ some. Keep the width as near as possible to the fourth part of the diameter of shaft. In thickness I vary still more.

There is one important feature of the case of which nothing has been said, and that is the effect of longer or shorter keys upon other dimensions.

Making a key for a $2\frac{15}{16}''$ or $3\frac{3}{16}''$ shaft $\frac{3}{4}''$ wide and $\frac{9}{16}''$ thick as per scale (thickness measured in the middle of length of key), said key is 8" long and with $\frac{5}{16}''$ taper per foot. This key will be $\frac{5}{8}''$ thick at one end, and $\frac{1}{2}''$ thick at the other end. When we drive out such a key and must use a so-called key drift, we have a fair thickness to hammer against without upsetting it, even if it was driven in very tight, and has been in use for a number of years in a damp place where it may have been partly rusted tight. Now let us take for an instance a key 16" long and $\frac{9}{16}''$ thick in the middle; it will be $\frac{11}{16}''$ on thick end and $\frac{7}{16}''$ on thin end, and if we are obliged to take it out with a key drift we have only $\frac{7}{16}''$ of metal to hammer against, and a long key is much tighter than a short one, and we ought to have, if any difference, more metal. According to the table, however, it is the reverse. If this key is in very tight the chances are that we will upset it by trying to drive it out, and the result in most instances is that it will not come out.

There cannot be a standard of thickness where keys vary greatly in length. Thickness should vary according to length. In order that we do not get too many sizes, I would suggest that we make keys say up to 10" long, the regular thickness given. If 14 to 16" long $\frac{1}{16}''$ thicker, and if 18 or 20" long $\frac{1}{8}''$ thicker, and so on.

I receive every year several shafts with pulleys on them sent to my works, sometimes only for the purpose of having the keys taken out and pulley taken off the shafts. In some cases the pulley must be broken and the hub split.

It is an old saying that a good general is more careful in making his plans to lead his soldiers out of a battle, in case he has to retreat, than to lead them in, and so it is with a key, and I therefore prefer quite a thick key, so that we can get it out if necessary. On special heavy work and very short hubs we put in two keys in one shaft 90° apart. With special long hubs where we cannot use keys with noses, the keys should be thicker than the standard, and ought therefore to have a second standard of sizes.

As shafts are made at the present time usually $\frac{1}{16}''$ less in diameter than even inches, I have made a scale of dimensions adapted to shafting as made:

Diameter of Shafts.	Width.	Thickness.
$\frac{3}{4}$ to $1\frac{1}{16}''$	$\frac{3}{16}''$	$\frac{3}{16}''$
$1\frac{1}{4}$ to $1\frac{5}{16}$	$\frac{1}{4}$	$\frac{1}{4}$
$1\frac{7}{16}$ to $1\frac{9}{16}$	$\frac{5}{16}$	$\frac{5}{16}$
$1\frac{11}{16}$ to $2\frac{1}{16}$	$\frac{3}{8}$	$\frac{3}{8}$
$2\frac{1}{16}$ to $2\frac{3}{16}$	$\frac{7}{16}$	$\frac{7}{16}$
$2\frac{3}{16}$ to $3\frac{3}{16}$	$\frac{1}{2}$	$\frac{1}{2}$
$3\frac{3}{16}$ to $3\frac{11}{16}$	$\frac{3}{4}$	$\frac{9}{16}$
$3\frac{11}{16}$ to $4\frac{1}{16}$	$\frac{7}{8}$	$\frac{5}{8}$
$4\frac{1}{16}$ to $4\frac{11}{16}$	1	$\frac{11}{16}$
$4\frac{11}{16}$ to $5\frac{3}{16}$	$1\frac{1}{8}$	$\frac{3}{4}$
$5\frac{3}{16}$ to $6\frac{3}{16}$	$1\frac{1}{4}$	$\frac{13}{16}$
$6\frac{3}{16}$ to $7\frac{3}{16}$	$1\frac{1}{2}$	1
$7\frac{3}{16}$ to $8\frac{3}{16}$	$1\frac{3}{4}$	$1\frac{1}{8}$

Keys longer than 10 inches, say 14 to 16", $\frac{1}{16}''$ thicker; keys longer than 10 inches, say 18 to 20", $\frac{1}{8}''$ thicker; and so on. Special short hubs to have two keys.

If the AMERICAN MACHINIST will give its aid and request men to criticise the articles on keys and give their opinions as to how they think keys should be made, we may come to a standard in a short time. P. PRYIBIL.

New York.

Use of Section Paper.

Editor American Machinist:

In your issue for Feb. 2, page 6, I notice with great interest a paragraph entitled, "Section Paper and Its Correct Use." Mr. Norris says it was first adopted by Brown & Sharpe Mfg. Co. in 1886. Considerably more than ten years earlier than that, I invented the same thing, and failing to induce Keuffel & Esser, and one or two other like concerns, to see any advantage in it, I bought a ream of brown paper and had it ruled. I inclose you a part of one of those sheets. I gave a part of my ream away to mechanical friends, and used considerable of it myself, but for several years past have not had frequent occasion. Its utility to the designer can hardly be over-estimated.

Mishawaka, Ind. R. D. O. SMITH.

Wetting Coal—Pumps.

Editor American Machinist:

Mr. Booth brings up the subject of wetting coal, and the use of the steam jet.

The writer made a test at one time to determine for his own practice whether the seeming advantage of a hotter fire, easier work, and less smoke that came from wetting coal was all right financially. The result obtained at that time with Clearfield coal and Harrison boiler was as follows:

Coal dry, amount per square foot of grate per hour in pounds, 12.6; per cent. ash, 6.89; water evaporated per pound of coal from water at 212° to steam at 212°, 10.33 pounds.

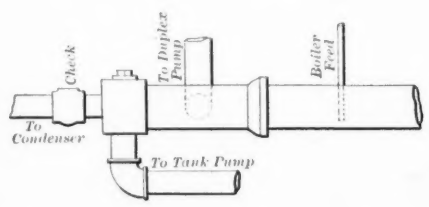
This test was for two days, when another test was made, the coal being weighed dry, and then wetted in the usual manner, but not weighing the water, with this result: Coal burned per square foot of grate per hour, 13 pounds; per cent. ash, 6.09; water per pound of coal from water at 212° to steam at 212° was 9.90 pounds. It is possible that there may be conditions where wetting coal will pay, but for general work I think the above is an indication of what might be expected.

Mr. Odell mentions cases that coincide with Mr. Booth's in regard to the steam jet. It would be interesting if these gentlemen could give us the amount of fuel saved by the methods named, or whether it simply resulted in the prevention of smoke, and a clean flame when fresh coal was put on the fire. A steam jet under the grate, or steam admitted to the ash-pit, even when it does not induce a current of air, will, in a large measure, reduce the formation of clinker, and change the color, character and volume of flame. This can be observed in the anthracites as well as the bituminous kinds of coal, and it has seemed to the writer that when an artificial draught was necessary a steam jet was preferable to a blower giving dry air, care being taken to keep the volume of steam below the decomposing capacity of the fire. Whether there is any saving I am not prepared to say, but have sometimes thought when watching it that it was as fascinating and possibly as illusive as the use of "Kem-Kom" and like ingredients. It would be interesting to hear from any one who has made tests of economy of the steam jet, either over or under the fire.

Engineers sometimes have lots of fun with pumps, and I will relate an experience that has been anything but pleasant.

The suction pipe was taken from a well that was fed from a river, and was 16" for a little over 100 feet, and 10" for nearly 200 feet. At the time it was laid it was expected to take a branch at the intersection of the 10" and 16".

The sketch shows a side view of the 10" pipe where the pumps were connected. There was an independent condenser having a 14" water cylinder, a tank pump with an 8" water cylinder that supplied water for various purposes, and kept at a pressure of 40 pounds with a pressure regulator; a duplex pump, with two 7" cylinders furnishing water for hydraulic cranes and elevators at a pressure of 150 pounds, and the boiler feed. The height of this pipe above the



water in the well was about 15 feet, and the duplex and boiler feed were about 4 feet above the other two. It was found to be impossible to get any water with the boiler feed as connected in the top of the pipe at first, so this was changed by carrying this pipe down to nearly the bottom of the 10" pipe, which remedied that difficulty.

The tank pump gave no trouble, and would take the water from the well at any time, even with no foot-valve.

The duplex pump gave continual trouble. In the first place it would not bring water from the well alone, but this had to be done with one of the others. It was all the while letting go and filling with air, and required constant priming, so that priming valves were put in, and a stream of water was continually running from the discharge into the cylinders. The builders said that they could send a man that would point out the trouble, or they would furnish a new pump that would work. Their expert came, and said that the only thing to do was to put in a separate suction pipe for this pump, but as it would not draw water when it had a suction pipe all to itself, it hardly seemed advisable to go to that expense for an uncertainty, especially as it had to go under a mill for over 150 feet. I put a check valve into the suction of this pump, and everything has gone in fairly good shape since, although the duplex will not start the water in the morning.

The builders intended to have an extra good working pump with large water passages, so they took a pair of 8" cylinders, and bushed them down to 7", which left an immense amount of clearance, and it is my impression that it is this large clearance that ruined the pump.

When there is a head of water, it may be all right to have large clearance in the water end of a pump, but if it must draw its water, care should be taken that no more is allowed than is actually necessary.

Most of the time there has been a foot-valve on this pipe, but when the pipe was opened to put in the check, it was seen that the water never filled the pipe over two-thirds full, which accounts for the boiler feed not working when connected at the top.

The 10" pipe is an ordinary bell and spigot, and apparently there is a leak, but as a large share of it has been built over, it is nearly an impossibility to get to it, and it will have to go as long as it will work.

This brings up another question. Is the bell and spigot the proper thing for a suction pipe? It is possible to lay the pipe so solid that the joints will not settle, but the changing temperature of summer and winter will alter the length, and must work on the joints, with the liability of producing leaks that might not be noticed in pipes under pressure, as the small amount would soak away in the ground, but in a suction would give an endless amount of trouble. A screwed pipe is not open to this objection, and if they could be made so as not to corrode, it would be the coming pipe for pump suction. W. E. CRANE.

A Side Tool.

Editor American Machinist:

In the AMERICAN MACHINIST for January 26, "A Mechanic" contributes an improvement in side tools. I desire to state that for the past 15 years I have tried to introduce this method of cutting away a portion of the tool to save grinding. I thought that there were some mechanics who could see the advantage of having a tool made in this manner. By constant watching I found that the majority of workmen would rather kill time at the grindstone in grinding the tool in the old way. I am pleased to say that I introduced this form of tool into the shop where I now work, and it is used extensively; the workmen would not use the old style again. C. E. SIMONDS.

Somerville, Mass.

Inventor Traps.

Editor American Machinist:

In the AMERICAN MACHINIST of Jan. 26, this year, I see an article entitled "Inventor Traps," and as I think I have fallen into one, I wish, through the AMERICAN MACHINIST, to expose the same. Having obtained several patents in the United States, I have received letters recommending the application of patents for said inventions in England, and last year, in May, I sent to some, to me entirely unknown, solicitors of patents in London, Eng., $15, which would secure my invention for a year, and have neither heard nor received any communication whatever, except a receipt for the money, since, and though I have written several times, received no answer. If other readers of the AMERICAN MACHINIST have had any similar experience, or if any one can tell me if and how I could obtain my money back, I would be very thankful.

P. A. M.

The Apprentice Question.

Editor American Machinist:

In your issue of January 5th you comment in your editorial on "Apprenticeship," and you say, "As far as the machinist trade is concerned there is almost or quite nothing in the cry that organizations of workingmen are preventing American boys from serving apprenticeships," etc. As a machinist, I think there should be established a legal apprenticeship system, either by the employers or workmen. The writer has worked in several shops in New England where the apprentices number half the machinists; some places they are equally divided. In such places they do not employ the boy with any intention whatever to teach him the trade, but for cheapness, though he is called an apprentice just the same. If he picks up the trade by his own abilities, all very well—they do not teach him. The outcome of the majority of them is that they leave because they do not get a "show," and they usually get into some other shop just as bad, on instructions, and finally become "tramp machinists." You often hear foremen complaining of the poor men that come along these days, yet they keep on making matters worse by filling their shops half full of apprentices, that little or no attempt is made at teaching. Perhaps competition demands this, but I think it will be bad for the machinist in the end; in fact, we see its effect now, with the country overrun with machinists, and wages coming to a lower rate every year.

I think the International Association of Machinists are just in their endeavor to secure the establishment of a legal apprentice system of four years, and one apprentice to every five machinists, which will well keep up the supply; and that a young man shall not be recognized as a machinist unless he serves his legal time, and shows papers to that effect. The employer, of course, would be expected to do his part in teaching the boy the trade. We would have better machinists, I believe. U. M.

Lathe Dogs.

Editor American Machinist:

I have an axiom that I thoroughly believe in; it is this: There are very few things in the field of mechanics that are not susceptible of improvement. In your issue of January 26 there is an illustration of a lathe dog which is very good indeed, as far as it goes, but in my opinion it has two faults. It should, I think, have a lug or projection on the lower right-hand corner, as shown in cut, to drive with and balance the screw; this would have the double advantage of reducing vibration at high speeds, have a tendency to force the driver on the work instead of pulling it off, and also be easier on screw than when driven from any other point on driver; secondly, the stud should be on face-plate adjustable to any distance from center of spindle to accommodate varying conditions, and long enough to project about 1' ahead of live center; a piece of iron pipe of any length can be slid over this stud to reach still further out, as is often necessary in lathe work. This, as is easily seen, does away with all torsion, or rather transfers it to face-plate and spindle, which can easily stand it, while the dog and work very often cannot. This very torsion is responsible for more broken clamp dog screws than any other cause. This enables the workman to get his work in and out of the lathe with much greater facility than the old, popular and unscientific lathe dog. How many men who read this article will recall the numberless times they have lifted a piece of work as high as the centers, supported it on left arm, wiggled around, and swore some in their efforts to get the dog tail in slot, live center in center of work, and then reached over about a rod to get hold of the foot-stock crank handle, while if they had but to stick it on center regardless of driver their work and difficulty would be lessened, to say nothing of that nut or piece of scrap-iron that they had inserted between shaft and end of dog screw, because the screw was too short from being broken off some time previously by the same torsional strain that loosened the scrap-iron as soon as the lathe was started and tool applied. Two good clamp drivers without tails and one adjustable stud in face-plate will take from nothing to six inches in diameter, will cost less and do as much and more work as regards variety than a full set of those antiquated things known as lathe dogs, do it better, and easier on work and workman, and minimize breakage of screws and springing of work in lathe.

Chicago, Ill. H. HARDINGE.

Simple Prony Brake Calculation.

Editor American Machinist:

Noting your remarks on the Prony brake in issue of Jan. 26th, it occurs to me to send you the data of the form I usually prefer as a matter of convenience.

First. I reduce the horse-power to the basis of seconds instead of minutes, to save figures, or 550 pounds raised 1 foot per second.

Then I make the length of my brake lever the radius of a 55-feet circle, or some integral part of it—$\frac{1}{2}$ or $\frac{1}{4}$.

The radius of such circle is 8.7535 feet, or 8 feet 9.04 inches, which is usually a good

length for heavy tests, such as turbine wheels, but which can be reduced to 4 feet 4½ inches for small powers.

Then by using a worm gear speed counter, which rings a bell every hundred revolutions, all I have to do is to divide the weight in the scale by the number of seconds between the strokes of the bell, and add the first decimal of the result, to get the horsepower at once. If the 4-feet 4½-inch lever is used, multiply result by 5.

Thus, in a recent test of a turbine, with an 8-feet 9-inch lever, I had 801 pounds in the scale, and the bell struck every 39 seconds.

Now $\frac{801}{39} = 20.538$, or 205.38 H. P.

This is a very easy and simple way of getting the result, if you can use a counter, which gives the time occupied by 100 revolutions, and may be of use to some of your readers. SAMUEL WEBBER.

Charlestown, N. H.

Mr. Arthur's Nationality Perhaps.

Editor American Machinist:

Mr. Arthur's letter has stirred up the *boys* very considerably, and the English section seem to think he is an American. Unless I am misinformed, he is a Britisher, and worked in one of the large locomotive shops in Great Britain, so he ought to have had a good opportunity to compare methods, and ought to speak with some authority. AVALON.

Kingston, Ont.

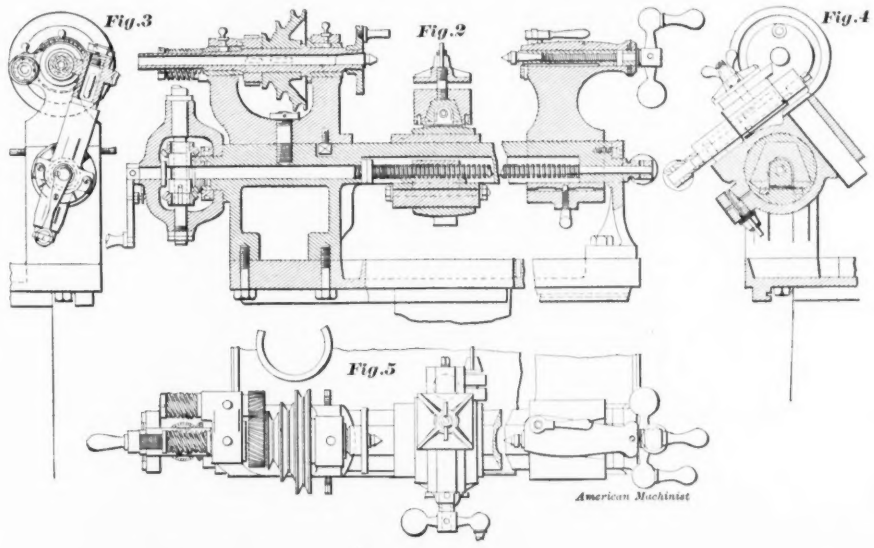
A Patent Case.

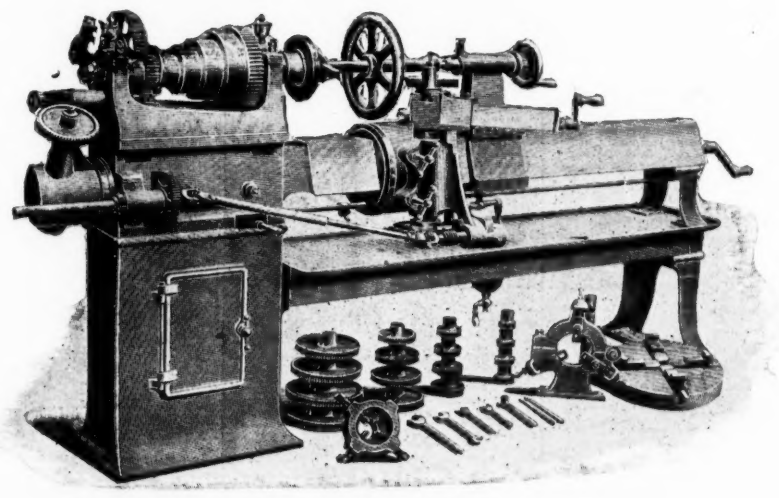
Editor American Machinist:

I read with much interest "Comments on the Patent System," by Mr. C. L. Redfield, in your issue for January 26. Comments so just in conception are altogether too rare; it is so much easier to find fault than to commend. I write this to express my approbation, and also to ask how the concluding suggestion would work in a case like this, which is actual in its detail, except as to the date of application, which I cannot state without search.

G., of Kalamazoo, made an application for letters patent, having prepared the drawings and specifications himself—not very skillfully. There is no question that this was the *first* application for a patent for this particular subject, nevertheless it was rejected. Being a poor man, and entitled under the law to two years delay, the matter was allowed to rest for about a year, when he instructed an attorney in Washington to look at the case, and advise him if it would be worth while to do anything more. The examination was made, and G. was advised that the rejection was not fatal. The case then rested about six months, and he sent a power of attorney with instructions to fix the case up. The attorney then set about amending, and at the end of another six months succeeded in getting the case, with proper claims, in a condition satisfactory to the office. He was then informed that subsequent to the application of G., three other people, one of them a foreigner, had filed applications for substantially the same invention, and that they had been put in interference, and that the interference had progressed so far that it could not be reopened to admit G., and that his case would be suspended pending the determination of the interference, and that he would then be put in interference with the successful party. The interference was not determined for *more than four years.* Then succeeded the most remarkable series of proceedings ever witnessed in the Patent Office, growing out of the combined ignorance of a new commissioner, a lawyer who had no knowledge of patents, and an absurd charge by the latter that G. was a conspirator seeking to prevent the successful interferent from getting his patent. The series of arguments and hearings which the commissioner then set up ran through nearly a year more. Finally, the new interference was declared, and notwithstanding G. proved by hundreds of citizens of Kalamazoo an actual working machine a year or two before his competitors' first experiments, the decision was against him. Now up to that point, which was at least five years ago, between seven and eight years had been consumed—mostly by the Patent Office itself. I asked one of G.'s attorneys about it, a few months ago, and he said the fight is not yet over. During the progress of it G. has died, and at least one of his attorneys.

The general desire is to get through the Patent Office without delay, and it is not often that a combination of circumstances exist making delay desirable. The 14-year case is exceptional. It is the Bell Telephone Co.'s. Having procured favorable decisions of the Bell original patent, they naturally desire to prolong the monopoly, but the thing essential to a commercial instrument was unfortunately invented shortly after attention was called to the telephone. The invention was purchased, and the application was made in due time, but upon one pretext or another, it has been nursed in the Patent Office for all these years. It goes into force just before the expiration of the Bell patent, and the company expects through it to continue control of all telephones using a battery for some sixteen years more. R. D. O. SMITH.





PITTLER'S UNIVERSAL TOOL.

Filing Technical Articles.

Editor American Machinist:

No doubt there are many others besides myself who would be thankful for a few suggestions from the older members of the profession, whose experience has given them a wealth of information, in regard to saving technical literature such as occurs in trade journals, etc. I believe I have full files of the representative industrial papers for the last few years, and I begin to think they would be of much more service to me if I had clipped the more valuable articles which were pertinent to my business and placed them on file with a suitable index. They would certainly be much more accessible and more frequently referred to. I have tried the envelope system of filing for odds and ends, which was fully explained in your columns a short time since, and take this opportunity to thank the writers, for it has certainly proved the best of any arrangement that has come to my notice. Now, are "bound volumes" of any more use than that they form a comprehensive history of the development of the various mechanic arts, and is not the filing system, with a careful and complete index, by far the preferable way in which to preserve those treasured bits of information? Perhaps, Mr. Editor, this has been duly discussed in the past numbers of your paper, but is it not of enough moment to the younger readers to call attention to it once more? I, for one, would feel under obligations for a little advice. O. A. SMITH.

A Machinist as a Grape Grower.

Editor American Machinist:

It will not be long now before spring will be upon us, and I presume a good many readers of the AMERICAN MACHINIST will begin to look after their gardens. Most all well-regulated gardens have some grapevines, and the object in writing this is to tell those readers of the AMERICAN MACHINIST who are fortunate enough to have a small garden, of a discovery that I made—or think I made—in regard to grape culture.

Last year the writer was somewhat late in the season in trimming the vines; the sap was pretty well up in them. I found that the vines immediately commenced to bleed, or the sap to run out, where the vine was cut. What to do to stop it I did not know. I got beeswax and put over the cut, and pasted it down nice over the stem; it made no difference how much wax I put on the sap would come through it any way. I studied over it for the next best thing to do, when I happened to think of a fellow shopmate that tried to put on a grindstone belt when the shaft was running, and, getting caught, was whirled around the shaft at a fearful speed. When we got the engine stopped—and the poor fellow cut loose—we found that both of his legs were broken in several places. I assisted the doctor in cutting them off. I noticed that the doctor put a rubber band around the good part of the limb to stop the flow of blood from the body, which it did during the operation. I thought, why won't the same plan stop my grape-vines from bleeding? So I got some No. 16 annealed wire, and twisted it tight around the end of the cut vine. The vine being soft and full of sap, it was tightly compressed by the wire band which completely stopped the flow of sap. If this is any benefit to your numerous readers they are welcome to it.

BENJ. F. HETHERINGTON.

Indianapolis, Ind.

Pittler's Universal Tool.

We reproduce from the columns of our English contemporary, *Engineering*, some engravings of a machine which has been exhibited in London, and is the invention of Mr. W. von Pittler, of Leipzig-Guhlis.

It will be seen that in general form this machine resembles a lathe, but has a bed with a cross-section shaped like a truncated triangle, in the center of which is placed the lead-screw, as shown in Figs. 2 and 4.

Fitted to this bed is a carriage which surrounds and bears upon all sides of it, the outer portion of this being turned to fit a split sleeve which fits over it, and which can be turned about it to any desired position and clamped in place. This sleeve has an extension at one side which is bored at right angles to the center line of the bed, and receives a cylindrical bar, to the upper end of which is attached the tool-rest, and to the lower end a worm-wheel, by which it can be rotated in the manner shown, or it can be clamped rigidly in place. By turning the sleeve upon the carriage the tool-rest may be moved to or from the centers, so that such a piece of work as a hand-wheel or a ball may be turned, and no other elevating device is needed.

The lead-screw is driven by either of two worms at the head of the lathe, one of these running at double the speed of the other, so that two threads are cut with each arrangement of change gears.

Bevel gears arranged as shown at the left of Fig. 2 reverse the motion of the screw. The outline drawings not being of the same machine as the perspective engraving, some things are shown upon each that are not shown upon the other, one of them being the method of driving the worm-wheel to rotate the tool-rest, as shown in the perspective engraving.

By using forms for the purpose, the sleeve which embraces the carriage can be rotated as the carriage feeds, and thus irregular forms are produced of almost any desired shape, one of these shown by our contemporary being a screw-threaded ball screwed into a hemispherical cup.

By arranging the part of the carriage sleeve which holds the tool-rest to swivel upon a pivot at right angles to the line of centers spiral gears are cut, the cutter arbor being held on the centers; and by mounting a cutter arbor upon the carriage, and driving it by a belt from the countershaft, spiral reamers are milled, the spindle of the lathe being then rotated slowly to give the desired spiral, by means of a worm and wheel driven by a shaft having universal joints or couplings. The readiness with which the tool-rest may be placed in almost any desired position renders it easy to apply and use attachments of almost any kind for gear cutting, worm-wheel hobbing, milling and such work, from which it takes its name of "the universal tool."

A writer in the *Engineering Magazine* announces the rather novel doctrine that skill acquired by workmen is acquired "at their employer's expense, and in time that he has paid for." The man who does not know that the rate of wages paid covers this expense of acquiring skill, or, in other words, that expense or risk which may arise from the lack of skill in workmen is allowed for in the rate of wages paid is, it seems to us, very poorly equipped for writing on industrial subjects.

Mr. Geo. A. Walker, who is well known to the machinery trade, has connected himself with M. M. Buck & Co., of St. Louis, and will take charge of a machinery department of their business, in which machine tools and engines will be kept in stock.

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NEW YORK, FEBRUARY 16, 1893.

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Machinists and Engineers in the Navy.

Quite a lively discussion of the points touched upon in Chief Engineer Melville's report is being carried on in the columns of *The New York Times*, a paper which devotes special attention to army and navy matters. A correspondent of the above-named paper, who signs himself "Fair Play," takes the position that no greater number of scientific educated engineers are needed, but that what is needed is a body of such men as run the engines of merchant ships, *i. e.*, machinists who, having had experience with marine engines, are competent to run and manage them. He declares that we now have in our navy a far greater proportion of scientific engineers—men educated in the theory of the steam engine and trained in engine design—than can be found in the navy of any other country, and that the proposed or asked-for increase would give us about six times as many such men per ship as are in the French or German navies. He claims that it is the present excess of scientific engineers on shipboard, and their reluctance to give the practical machinists any real responsibility or fair treatment that is the main cause of the trouble with the machinists. He sums up his statement of the case in the following words:

"To sum up, the bill to increase the engineer corps of the navy to 303 commissioned officers may appropriately be called 'An act to prevent the organization of a corps of engine drivers for the navy; to prevent the possibility of giving the machinist better quarters or better pay; to prevent giving promotion and encouragement to apprentices—'self-respecting, skilled workmen.' It postpones the 'proper time' for considering the machinists' claims until we get 303 designing engineers, and it asserts that the American machinist cannot be trusted to run engines in the navy; it fills the navy with engineers who become 'nervous wrecks in a week or two,' and deprives it of the practical engine drivers who are trusted to run engines in the merchant service and in the 'monarchical military establishments' of Europe; it declares that the American mechanic is less trustworthy than the foreigner, and no measure has ever been proposed that tends so surely to discourage 'self-respecting' Americans from accepting an apprenticeship in the engineer department of a man-of-war."

This may be putting the case pretty strong, but it is at least interesting as showing how the matter may be regarded by one who is undoubtedly well acquainted with naval matters.

It is undeniably true that the engines of merchant steamships are managed by men who, whatever else they may be, are first and above everything else practical machinists. Whether or not there is any advantage in having scientific engine designers in charge of engines at sea may be a disputed question.

In the merchant service such men are not employed in running engines, though many of the men so employed do, by application and study, become capable of designing.

But the one thing we are quite certain of is, that whoever is engineer of a vessel, and is responsible for the work in that department, should have absolute control of that department, and no one should have the authority to either take his men away from their positions without his knowledge and consent, nor to interfere with him in any way in the management of his department.

Technical Knowledge Not Needed.

A story published in a New York daily describes how the group of reporters detailed to gather marine news guyed a new man put on by one of the papers, as a substitute, who began by declaring his belief that no special knowledge or ability were required for the work.

Among the stories given him to publish in his paper was the following:

"The California night boat was seven hours late in arriving yesterday. She was delayed by the dolphin striker fouling the propeller while unmooring. One of the main-clew garnets, which was used to clear it, caught in the starboard flemish horse and became wound around the fore foot. It carried away the pacific iron and injured truss and capshores.

"When the engines were started again the propeller strut on the starboard side broke short off. One of the spare knightheads was substituted, but it was unequal to the strain. As a last resort the keelson was unshipped and lashed to the dislocated part. By this means the vessel finally succeeded in reaching port. There were a large number of passengers on board. Their appreciation of the seamanship of the captain and his officers was expressed in an illuminated testimonial."

This, of course, is very funny to one who knows anything of marine matters. But suppose that one of the Boston boats, the "Pilgrim," for instance, which has a simple beam engine and paddle wheels, had come in late, and the engineer had accounted for it in the following manner: "The revolution counter gave way without warning, and its failure to control the speed of the engine caused the thrust bearing to heat and finally burst, scattering the fragments about the engine room. One of these fragments struck the boiler head, fracturing it and allowing the boiler to become partially filled with ashes, while another struck the vacuum pan, breaking it, and letting the vacuum escape into the connecting rod of the high-pressure cylinder cover. The extra pressure thus thrown on this connecting rod twisted it so that it had to be replaced by one of the boiler flues, which was taken out and fastened in its place by heavy chains, and a cement made of equal parts of glue and iron filings. As we had no iron filings on hand, and had to file up the brasses of the disabled connecting rod to get a supply, it took considerable time to get started again." There can be no doubt that every one of the brilliant marine reporters would have turned in to his paper such an account, and in the full belief that it was correct and accurate in every detail.

Arthur T. Woods.

Prof. Arthur T. Woods, who was well known to our readers through his valuable contributions to our columns, died of typhoid fever in Chicago on the 7th inst. Prof. Woods was a graduate of Annapolis and served afterwards in the steam engineering department of the navy. He was afterwards Professor of Mechanical Engineering at the Illinois State University, leaving there to become Professor of Dynamic Engineering at Washington University, St. Louis. For about a year he has been one of the editors of the *Railroad Gazette*, which work kept him in Chicago, where he has fallen a victim to the bad sanitary conditions. Prof. Woods' contributions to our columns on "Laying Out Curves for Cams" and on "Epicyclic Trains" will be especially remembered, and are preserved by many mechanics for reference on these subjects. A series of articles by him, published in the *Car and Locomotive Builder*, on the "Compound Locomotive," were published in book form, and constitute thus far the best and most comprehensive treatment of that subject. He became a member of the American Society of Mechanical Engineers in 1883. Prof. Woods was exceedingly well liked by all who knew him, and his death at the early age of 34 years is a distinct loss to mechanical engineering. He leaves a widow, the daughter of Admiral De Krafft, U. S. N.

Literary Notes.

ELECTRICITY AND MAGNETISM. Being a series of advanced Primers of Electricity. By Edwin J. Houston, A. M., Professor of Natural Philosophy and Physical Geography in the Central High School of Philadelphia; Professor of Physics in the Franklin Institute of Pennsylvania; Electrician of the International Electrical Exhibition, etc.

This is an excellent little book of 306 pages, including an index. The subjects are presented in a very simple and popular style, easy to read and to understand, and accompanied by practical deductions and applications, the whole forming a book well adapted for beginners and practical men who wish to become familiar with the science of electricity and magnetism. Although the work is primarily intended for popular reading, the care in statements and logical development of principles make it valuable for advanced students. The book is divided into 18 parts, called primers, and treats on the following topics: Effects of electrical charge. Insulators and conductors. Effects of an electric charge. Electric sources. Electro-receptive devices. Electric current. Electric units. Electric work and power. Varieties of electric circuits. Magnetism. Magnetic induction. Theories of magnetism. Phenomena of the earth's magnetism. Electro-magnets. Electrostatic induction. Frictional and influence machines. Atmospheric electricity. The last part gives a review of the foregoing, and sums up the salient features of the different topics treated.

A feature of the work is the abstracts from standard electrical books at the end of each primer, which generally have reference and furnish an extension to some important point in the primer, and, at the same time, give the reader an introduction to electrical literature, giving the student some idea of the character of these works, and enabling him to intelligently select the works best suited to his needs.

The book is published by the W. J. Johnston Company, limited, 41 Park Row, New York. Price, $1.

ICE-MAKING MACHINES: The Theory of the Action of the various Forms of Cold-producing or So-called Ice Machines. Translated from the French of M. Ledoux, Ingenieur des Mines. Revised and Transformed to English Units by J. E. Denton, D. S. Jacobus and A. Riesenberger.

Those who are in any way interested in the action of ice machines and the thermodynamic discussion of the various fluids used for the artificial production of cold will find this little volume of 190 pages an extremely valuable one. In order to make this work available to students and practical men all the figures have been transformed to English units, and all results expressed in the units commonly used in American practice.

Intermediate steps not fully indicated in the original have been supplied in the form of foot-notes. The latter have also been liberally introduced to emphasize important points of the text, and to call attention to modifications of the author's views suggested by the most recent practice and experiments. Several tables have been added to make the work more complete; and the appendix contains comparisons of theoretical deductions, and the experimental results of other authors.

This book is one of Van Nostrand's science series. It is published by D. Van Nostrand Company, 23 Murray and 27 Warren street, New York. Price, 50 cents.

ERRORS IN SCHOOL BOOKS.—This is a pamphlet published by Col. Albert A. Pope, of Boston, who is doing a good work by offering prizes of bicycles to teachers who point out mistakes in school text-books. Many of them have been thus discovered, made known to the publishers, and corrected, most publishers being, of course, glad to have such errors as exist pointed out. A curious exception, however, is to be noted in the case of John E. Potter & Co., one of whose geographies makes the statement that the sun stands still. Their attention being called to the error, they replied that "for all practical purposes [the sun] does stand still," and upon being shown by the authority of Prof. Holden, of Lick Observatory, that it does not, they wrote: "We are not astronomers, and have given this subject very little attention, so that we cannot enter into the argument with you about it; the commonly received opinion is that the sun stands still, and for all practical purposes this seems to be sufficient to say about it. It is very likely it does not stand still, *but the sun is too far away to know very much about it definitely.*" . . (The italics are ours.)

We hope not many children have to get instruction from books published by a firm showing no more interest in having them correct. Children who are deliberately taught errors that they must afterwards unlearn are to be pitied. It is gratifying to know that text-books generally have stood

the test very well, however. While the corrections are being made we hope an error pointed out by us in our issue of October 9, 1890, will be corrected. This error occurred in one of Harper's school geographies, which states among the reasons for the non-adoption of standard time in some places that many occupations are "dependent upon sunlight," as though the amount of sunlight available for these occupations depended somewhat upon the particular position of the minute hands of timepieces with respect to the sun.

We have received a copy of the "Journal of the New England Water Works Association." It contains much valuable information relating to laying a siphon under Brood canal, Cambridge, Mass.; the effect of the aeration of natural waters; the purification of drinking water by sand filtration, and much other new and interesting matter. The Appendix gives a reduced fac-simile of the report of the metropolitan water supply, London, England, and a number of fine illustrations relating to foreign water works. This journal is issued quarterly, and is published by the Board of Editors, Junior Editor's office, New London, Conn. Price per number, 75 cents.

The name of *The Northwestern Mechanic*, published at Minneapolis, has been changed to *American Mechanic*.

Questions and Answers.

Questions of general interest relating to subjects discussed in our columns will receive attention in this department. The writer's name and address should always accompany the question. Neither correct initials nor location will be published when there is a request to that effect. If questions are enclosed with a business communication, they should be written on a separate sheet.

(62) L. P. K., ——, writes: Please inform me if there are any instruments for indicating temperatures up to 400 degrees. *A.*—Yes. 2. Who sells them? *A.*—Write for pyrometers to any dealer in machinists' tools and supplies.

(63) C. W. P., Cincinnati, Ohio, writes: Please inform me in regard to the following: Under what pressure will illuminating gas liquefy? 2. What space would 2,000 cubic feet of coal gas occupy if compressed to a liquid state? *A.*—We have not been able to find any data relating to this subject.

(64) B. M. A., Marathon, N. Y., writes: Do any of your issues contain articles which explain the methods of making blue-prints, and giving full directions for making bath trays, etc.? If so please give number of issue. *A.*—January 29, 1887, and answer to Question 117 in our issue of March 5, 1891.

(65) F. T., Miles, Ohio, writes: Please favor me by stating where I can get a good book that treats on mechanical drawing. I am a practical machinist and want to practice drawing in the evenings at home? *A.*—We believe that the articles on practical drawing recently published in our columns will answer your purpose. We can furnish any or all of these numbers.

(66) X. X., Chicago, Ill., writes: Please inform me if a man intrusted with the care of an engine supplied with steam from an adjoining building must have a license in districts where such are granted to engineers. *A.*—We believe not. But since the same laws are not enacted in all localities it is best to make inquiries, generally at the police department in the locality in which you wish to work.

(67) E. S. W., Denver, Colo., writes: Please answer the following: What is the difference between spiral and helical springs? *A.*—A spiral spring is one which is wound around a fixed point or center, and continually receding from it like a watch spring. A helical spring is one which is wound around an arbor, and at the same time advancing like the thread of a screw; springs for safety valves are generally helical springs. Your other question is too indefinite to answer.

(68) J. N. J., Pawtucket, R. I., writes: The answer to the following question will decide a long-standing argument. Suppose I have two pieces of steel 6 inches diameter and 2 inches thick, the same quality of metal in both. I bore a 2-inch hole in one piece in the direction of its axis and a 4-inch hole in the other, then heat both pieces to a cherry-red, and cool both in the same water at the same time. If, now, the piece with a 2-inch hole shrinks, will the other one with the 4-inch hole shrink in the same proportion? *A.*—Heating the steel to a cherry-red and then cooling it in water will harden it. The shrinkage of steel in hardening follows no fixed law, and it is impossible for any one to state what the result will be. The two pieces of steel referred to may or may not have a proportionate shrinkage.

(69) M. D., Moringo, Ill., writes: Please give me a method for holding thin pieces of steel while being planed; say pieces $\frac{3}{16}$ inch thick and 4 inches wide and 3 or 4 feet long. *A.*—Tap the planer stakes for steel bolts, which should be fitted loosely enough in the stakes to turn easily, and should have comparatively large centers. Lay the piece to be planed on the bed, insert the stakes along each side of it, and place a round steel piece with pointed ends between each bolt and the piece to be planed, the latter having center punch marks in which one end of the round steel rests, and its opposite end resting in the bolt center, then screw up. The number of stakes required will depend on the length of the piece.

(70) P. & D., San Diego, Cal., write: We intend to equip and start a small machine shop for general, special and model work, and would like your opinion as to the comparative qualities of small power motors. As most people seem to have a wire in their heads, we thought possibly an electric motor would be more attractive, but we know little of their working condition, etc. *A.*—It seems to us that in starting a machine shop it should be your aim to earn a reputation for turning out good work, and making the enterprise a financial success; the attractiveness of the motor should be the last thing considered. The selection of the motor should be based solely on the cost of the power delivered to the tools, and we should adopt such as in your locality will deliver the power for the least cost.

(71) A. N. J., Newark, Del., asks: Which is the proper and best side of a belt to put on the pulley, the rough or smooth side? and what percentage of wear does one side have over the other? *A.*—The strongest part of belt leather is near the flesh side, about one-third the way through from that side. It is therefore desirable to run the grain (hair) side on the pulley, in order that the strongest part of the belt may be subject to the least wear. The flesh side is not liable to crack as the grain side will do when the belt is old, hence it is better to crimp the grain than to stretch it. Leather belts running with the grain side to the pulley will drive 30 per cent. more than with the flesh side. The belt as well as the pulley adheres best when smooth, and the grain side adheres best because it is the smoothest.

(72) G. W., Donald, Australia, writes: Are there in use any levers described as follows: So far, I have applied it to a lifting jack only. The lever is operated by moving one end up and down, which causes the jack to lift a weight to any height within its capacity. In order to reverse the motion the lever is operated in a similar manner. Can such a lever be usefully employed for any known purpose? *A.*—You evidently refer to a simple ratchet lever; this is used for many purposes; the familiar ratchet drill shows one form of its application. 2. Are there any steam engines in which the full leverage of crank is usefully employed when the piston is at the end of its stroke? *A.*—No. 3. If all the expansions of the steam in the cylinder are utilized, and the exhaust steam allowed to flow into a large chamber, will the exhaust steam need to be condensed? *A.*—Yes. The expansion of steam in a steam engine cylinder is always limited. Evidently you have had no experience in steam engineering, and attempt to study it without studying its first principles. Such a course is sure to lead to a waste of time and disappointment.

(73) D. R. A., Philadelphia, Pa., writes: In determining the capacity of an independent air-pump and jet condenser to do a certain work, what relative proportions of plunger displacement would you allow for air and water? *A.*—The following formula for designing the air-pump for a jet condenser gives good results in ordinary practice:

$$\frac{\pi \times d^2}{4} \times \frac{L \times S}{1{,}728} = 1.28\,(q + Q),$$

in which $\pi = 3.1416$; d, diameter of air-pump in inches; L, length of stroke of air-pump in inches; S, number of delivering strokes made; q, the volume of condensed steam per minute in cubic feet; and Q the number of cubic feet of condensing water used per minute. The formula is based on the following data: Absolute pressure of steam in the condenser = 2 pounds and temperature of the injection water = 70 degrees Fahr. The formula shows that the allowance for air is 1.28 times the sum of the quantities of condensed steam and injection water. From the foregoing formula we obtain for the diameter of an air pump for a jet condenser,

$$d = 53.6 \sqrt{\frac{q + Q}{L \times S}} \qquad (2)$$

The quantity Q of the injection water is generally assumed to be 27 times greater than the quantity of condensed steam. Adopting this ratio, the formula (2) reduces to

$$d = 280.8 \sqrt{\frac{q}{L \times S}} \qquad (3)$$

The following example will show the application of the formula. Number of delivering strokes is 65 per minute; length of stroke, 42 inches; quantity of condensed steam, 9 cubic feet. The diameter of the air-pump under these conditions will be

$$d = 280.8 \sqrt{\frac{9}{65 \times 42}} = 16 \text{ inches.}$$

In computing the diameter of an air-pump for a surface condenser, the quantity Q in formula (2) is 0; hence, for finding the diameter of the air-pump for a surface condenser, we have

$$d = 53.6 \sqrt{\frac{q}{L \times S}} \qquad (4)$$

If the pump is single-acting, and is well designed, its efficiency is about 0.6, in practice it is often taken at 0.5; according to this, the size of the pump should be double that given by theoretical calculations. The efficiency of a double-acting air-pump varies from 0.5 to 0.3, and generally it is not more than 0.35. 2. Does your answer to Question 486, published December 25, 1890, apply to a jet condenser, or to a surface condenser? *A.*—It applies to both.

(74) A. L. E., Elkhart, Ind., writes: Please give me a rule for setting the eccentrics on a locomotive engine without running the valves over to see that they are right. For instance, say that I have a new pair of wheels, and a new axle, and I want to key the eccentrics permanently in place before the valve motion is adjusted, how shall I proceed? I have read your paper for years, and also books, but fail to find anything relating to this subject. *A.*—Unless you are a good draftsman, you will have difficulty in finding the correct positions of eccentrics on the axle, because it involves the making of a skeleton diagram or drawing of the valve gear. We will simply indicate here the mode of procedure for the simplest case. In the first place, the correct relative position of the main axle and the rocker must be drawn, say, on a board; then draw a line through the center of the main axle tangent to the arc described by the center of the lower rocker arm pin; this will be the lower center line of motion. From the center of the axle draw a circle, with a radius equal to the eccentricity of the eccentrics. Through the center of the axle draw a line perpendicular to the center line of motion; parallel to the former, at a distance equal to the lap and lead measured off towards the crank, draw another straight line; the points in which this line cuts the circle previously drawn will be the positions of the centers of the eccentrics; the points in which the radial lines, drawn through the center of the axle and the centers of eccentrics, intersect a circle representing the axle, will give the positions of the eccentrics on the surface of the axle. If the center of the axle and the axis of the cylinder lie in one straight line, then draw through the center of the axle a horizontal line, and in this way establish the relative positions of the crank and eccentrics on one side of the engine; the relative positions on the other side are found in precisely the same manner. After this, the eccentrics may be set by a method similar to that given in our issue of October 24, 1885. The above is correct only when the rocker arms are of equal lengths. If the lower rocker arm is shorter than the upper one, then the distance between the centers of eccentric and the line drawn perpendicular to center line of motion will be proportionately less, and if the lower rocker arms are longer than the upper ones, this distance will be proportionately greater. Again, if the axis of the cylinder is above the center of the main axle, as is usually the case, the relative position of the crank and the eccentrics will also be changed. From this it will be seen that, before the eccentrics can be set on the axle, much preliminary drawing will have to be done for finding the relative position of the eccentrics and the crank. If you study the papers relating to the valve motion in the series of articles on modern locomotive construction, recently concluded in the AMERICAN MACHINIST, and thoroughly understand the underlying principles, the whole subject will present no difficulty. Generally the best way is to get the relative positions of eccentrics and cranks from the draftsman, after that the mode of procedure will readily suggest itself to any good mechanic. Your second question is of no practical value; do not waste time in arguing or studying the subject.

Business Specials

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.

Grant's Gear Advertisement is always on page 11.

Shafting Straighteners. J. H. Wells, Tampa, Fla.

Ideal Drawing Stands. M. C. Hammett, Troy, N. Y.

Forming Lathes Mer. Mach Tool Co., Meriden, Ct.

Tool Holder: Armstrong Bros. Tool Co., Chicago.

Norway Rivets, Evans & Robertson, Cincinnati, O.

6-Spindle Turret Drills A. O. Quint, Hartford, Ct.

"Bradley's Power Hammers, the best in the world." 20 sizes. Bradley & Co., Syracuse, N. Y.

Pattern and Brand Letters. A variety of sizes and styles. Heber Wells, 8 Spruce St., New York.

Drill Presses, with Tapping Attachments.
Gould & Eberhardt, Newark, N. J.

Davis Key Seating Machines kept in stock by Manning, Maxwell & Moore, 111 Liberty St, N. Y.

Selden Packing for stuffing box, with or without rubber core Randolph Brandt, 38 Cortlandt st., N Y.

Pulley lathes, most efficient offered. The Lodge & Shipley Machine Tool Co., Cincinnati, O.

Engine Castings, Humphrey's Foundry, Bellefontaine, O.

Practical Books for Engineers, Firemen, Power Users. Cat. free. Pract'l Pub. Co., 21 Park Row, N.Y.

Clayton Air Compressor Works, 43 Dey St., N. Y Compressors for experim'ts to 300 lbs. pressure, $50

For Cypress Tanks and Vats, address W. E. Caldwell Co., Floyd and Main Streets, Louisville, Ky.

Guild & Garrison, Brooklyn, N. Y., manufacture steam pumps, vacuum pumps, vacuum apparatus, air pumps, acid blowers, filter press pumps, etc.

"Shapers (Double Triple Quick Stroke")
Trade Mark.
Gould & Eberhardt Newark, N. J.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocum & Son's Shafting Works, Drinker St., Philadelphia, Pa.

Most sensitive and durable Damper Regulator made; works within one pound. Send for circular. T. Kieley, 11 W. Thirteenth Street, New York.

For the Latest Improved Diamond Prospecting Drill, address the M C. Bullock Mfg. Co., corner Canal and Washington Sts., Chicago, Ill.

Combination, duplex and special gear cutters in stock and to order. R. M. Clough, Tolland, Conn.

We electrotype illustrations and advertisements for manufacturers Prompt and thorough service. Send for estimates. A. Mugford, Hartford, Conn.

Roper's Practical Handy-Books for Engineers & Firemen; Descriptive Catalogue mailed free. Edward Meeks, Pub., 1012 Walnut St., Philadelphia, Pa.

Gear Cutters, Auto. Specially adapted for Motor Gears and all other style Gears.
Gould & Eberhardt, Newark, N. J.

S. W. Card & Co., Mansfield, Mass., are putting on the market a new line of stocks and dies, with their patent adjustable dies and guide. S. A. Smith, 23 S. Canal Street, Chicago, Ill., Western Agent.

Patent Soliciting of High Class.
D. Walter Brown, Counsel in Patent Cases,
31 Nassau Street, New York.
Send for Brief History of Patent Legislation.

De Lamater Screw Propeller Wheel, made only by The Samuel L. Moore & Sons Co., Elizabethport, N. J., who have purchased from C. H. De Lamater & Co., New York, all their patterns, books of record, gauges, etc. Location and equipment well adapted for Heavy Steamship Repairs.

"Binders" for the AMERICAN MACHINIST. Two styles—the "Common Sense," as heretofore sold by us, and mailed to any address at $1.00 each, and the "New Handy," mailed at 50c. each. The former has stiff board covers, while the latter has flexible covers with full page opening flat. Either will hold the entire 52 issues of any volume. AMERICAN MACHINIST PUBLISHING CO., 203 Broadway, New York.

"Indicator Practice and Steam Engine Economy." By F. F. Hemenway. Contains plain directions for using the indicator and making all required calculations from the diagram, also the principles of economy in operating steam engines and current practice in testing engines and boilers. Price, $2 postpaid. Published by John Wiley & Sons, 53 East Tenth Street, New York.

Engines of the Yacht "Neaira."

These engines (illustrated by Fig. 1) were designed and patented by T. Main, 1304 Garden street, Hoboken, N. J., and constructed by R. Wetherill & Co., of Chester, Pa.

The "Neaira" is built of steel, and is 110 feet long on the water line, 20 feet beam, and 10 feet deep, with 7 feet 3 inches draught of water aft; mean draught, 5 feet 10 inches; speed, 13.6 knots an hour.

The engines are of the balanced compound type; the high-pressure cylinder is 15 inches diameter, and the low-pressure is 28 inches diameter by 16 inches stroke; the cylinders are placed at an angle of about 23 degrees apart, and the cranks are directly opposite, so that the working parts of the one engine very nearly balance similar parts of the other. The pistons work in opposite directions, consequently the pressure of one piston is nearly balanced by that of the other through the crank, and the pressure on the shaft journals is reduced. This causes a great reduction of friction in passing the centers, and consequently increases the power.

These engines require only two journals, which makes a great reduction of length in a fore-and-aft direction, and which, in this vessel, allowed for an additional row of state-rooms athwartship, which was a very great advantage to the owner.

The valve motion is taken from the connecting rods, and piston valves are used on both cylinders, which are controlled by one starting handle for starting, stopping, going ahead, backing, or working expansively. And owing to the engines being at an angle to each other they have no dead centers, but can be controlled under all conditions.

The surface condenser is located on one side of the engines, with independent air and circulating pumps under it. The feed pump is also independent. The thrust bearing is bolted to the bed-plate, and accessible in the engine room. In this type of engines the journals require less wearing surface than usual, and tend to remain cool when running fast, owing to the work on them being light.

It is believed that there is no type of engines before the public to-day so compact as these, or which admits of so much power being located in so small a space.

Steam is supplied at a pressure of 125 to 150 pounds by a Scotch type of boiler (illustrated by Fig. 2) with two corrugated furnaces 33 inches diameter; the boiler is 8 feet diameter by 10 feet long, has a steam drum and an air heater located at the base of the smoke pipe.

T. Main's system of hot blast is fitted to the boiler. A fan blower driven by a pair of balanced compound engines 3½ and 6 inches diameter by 4½ inches stroke is used to draw air from over the boiler, and forcing it through the air heater into the closed furnaces; 80 per cent. of this air goes under the grate, and 20 per cent. of it above, at a temperature of 220 degrees.

This vessel has run several times from New York to New London, a distance of 110 statute miles, in seven hours, consuming two tons of coal during the run.

The engines have been run at a maximum speed of 180 revolutions, with 150 pounds steam, and indicated 348 horse-power.

They have been used during six yachting seasons, very little has been done to them, and they are now in good condition.

A modified plan of the blowing engines on this yacht is illustrated by Fig. 3, adapting them for use on small yachts or launches, for running dynamos, blowers, or for stationary work.

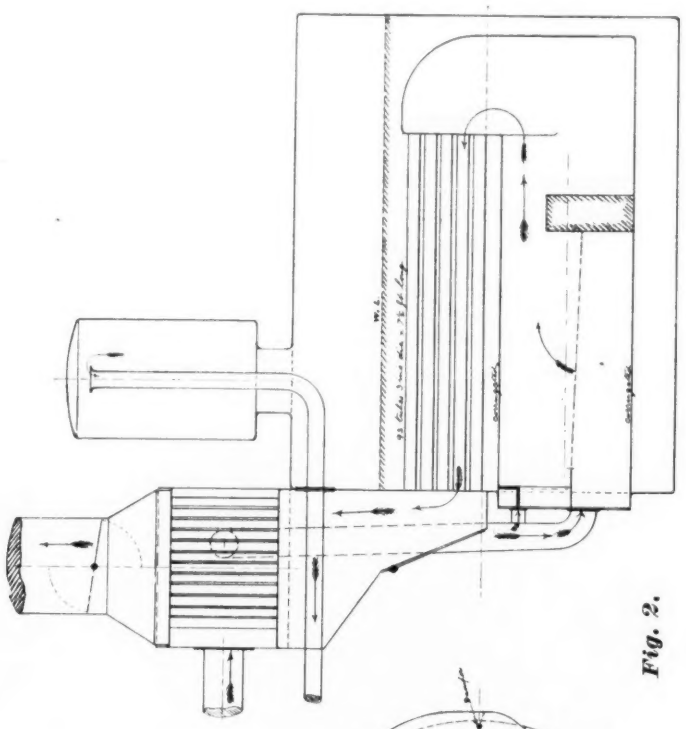

Fig. 2.

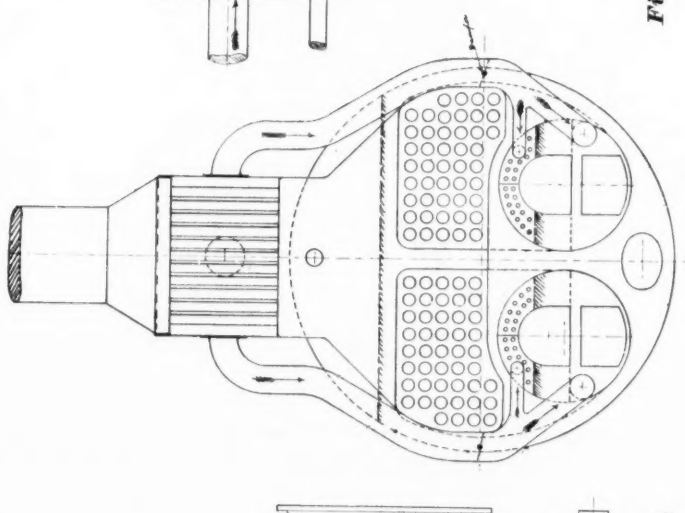

Fig. 1.

When it is an object in addition to compactness to attain a high degree of economy of fuel (and it always is or should be) these balanced engines can be arranged as quadruple expansion engines, fitted with steam jackets, to use steam of 200 to 250 pounds pressure, supplied from water-tube boilers, such as the Bellville, Almy, Roberts or similar boilers, fitted on the hot blast system. It is claimed such a combination will produce an indicated horse-power on one pound of coal per hour when properly carried out and worked. Fig. 4 represents the engines of the "Neaira" modified as balanced quadruple tandem engines, fitted with steam jackets on three cylinders, and so arranged with movable stuffing boxes that the lower pistons, cylinder heads and valves can be removed without disturbing the upper cylinders, and all this will occupy no more space than an ordinary single upright engine.

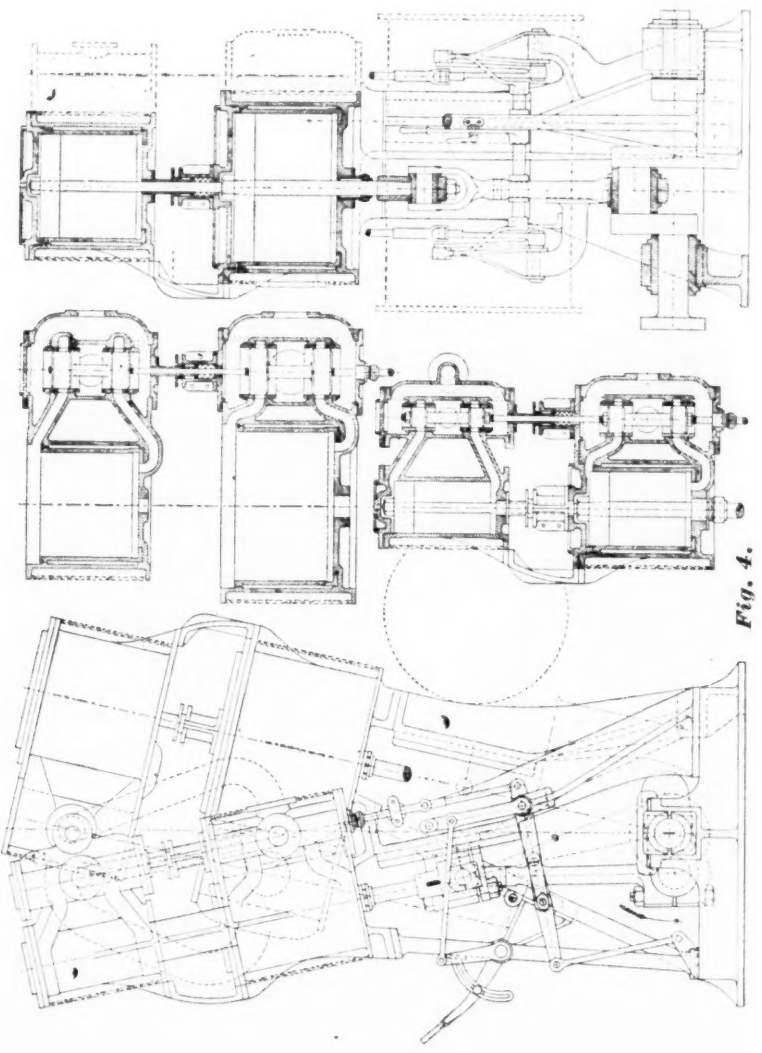

Fig. 4.

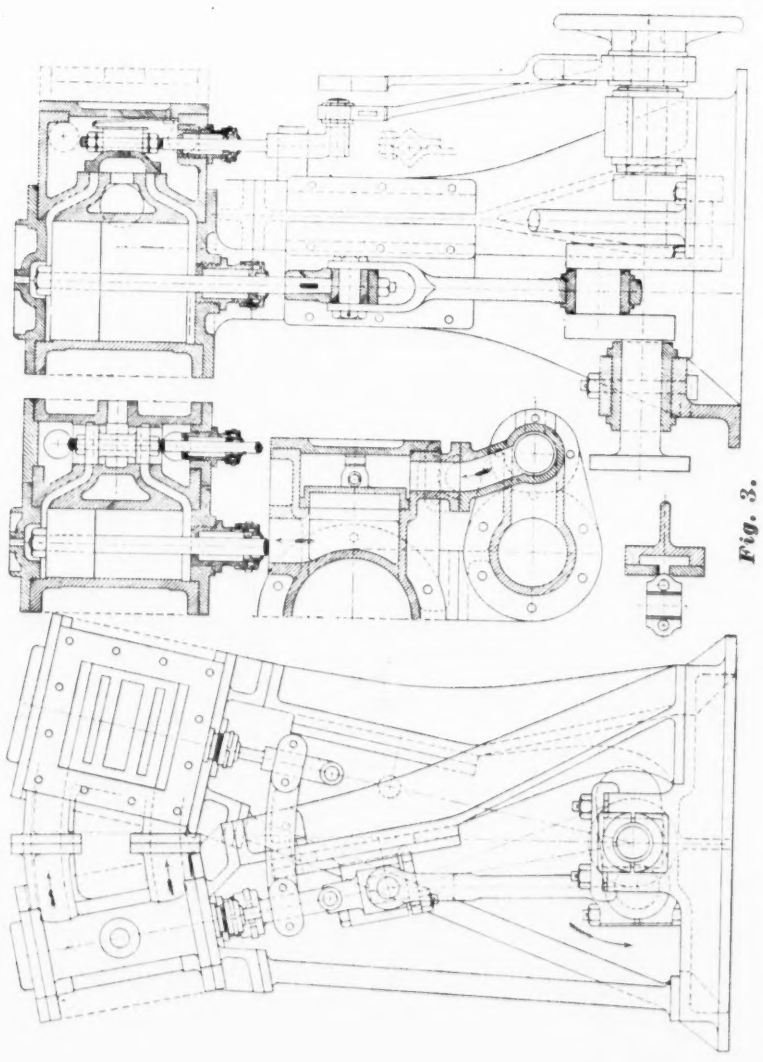

Fig. 3.

Engines with cylinders 13 and 24 inches diameter by 16 inches stroke, similar to those

on the "Neaira," have also been used on the steam yacht "Restless," 100 feet long, by 16 feet beam, and 9 feet 6 inches deep, for six seasons with good success.

MANUFACTURES

The proprietors of the electric plant in Petersburg, Ill., are going to enlarge and add a dynamo, with a capacity of 1,000 incandescent lights.

The Wells Machine Works, Fostoria, O., manufacturers of pipe-threading machinery, write us that they have disposed of their business to the Merrell Mfg. Co., of Toledo, O., which company will conduct the business hereafter.

A. J. Wilkinson & Co., 184 Washington street Boston, Mass., write us that they have purchased the patterns, tools, etc., of the upright drill formerly made by Sterling Elliott, Newton, Mass., and will hereafter manufacture these drills for the general market.

Preparations are in progress for the establishment of the proposed new corn-packing industry in Foxcroft, Me. The spacious building adjoining the Exchange stable, formerly occupied by J. F. Arnold & Son, has been secured, and will be used as a manufactory for tin cans. Workmen and a supply of tin arrived this week, and operations will begin at once.

Auburn, Me., has another shoe manufacturing firm added to its already large list. The Bowie Brothers, Auburn young men for some time past in the employ of Pray, Small & Co., have taken quarters in Roak Block, and are putting in machinery for the manufacture of misses' and children's shoes. They are to run by electric motor. The Auburn Motor Company is building them a dynamo.

Rockland, Me., is to have a new coopering industry, Messrs. Ed. Blake, Levi Whitcomb, F. M. Bailey and Charles G. Havener having begun preparations for going into the business at City Point. They intend to fit up a building on Gamman's wharf with engine, saws, stave machines, etc., and manufacture lime casks, making their own staves and heading. They may also add the sawing of spool wood to the business later.

The Red Beach Granite Company, Calais, Me., who are to inaugurate the granite cutting and polishing industry upon an extensive scale, have the exterior of their buildings practically completed. The machinery will be in place in early spring, and inside work will be pushed during the winter. The officers of the company are: W. A. Murchie, president; L. G. Downes, treasurer; H. D. Pike, secretary; George Green, manager.

The Portland Tinware Company was organized at Portland, Me., recently, with a capital stock of $50,000, of which $10,000 is paid in, and the following officers: President, Louis W. Bradstreet, Portland; treasurer, Fred E. Briggs, Deering; clerk, Edward B. Crockett, Deering. This company will occupy the commodious building owned by the Brown estate at No. 109 Cross street, and will manufacture tinware, sheet metal goods, and other products made from wood and iron. The lower floor of this building will be fitted up for a store where will be kept, at wholesale, goods manufactured by this company, and department store supplies.

The firm of Frasse & Company of 92 Park row, this city, has been succeeded by The Frasse Co., of the same place, this meaning simply that the company has been incorporated. In connection with the announcement of this change a circular has been issued, in which are some interesting facts from which we take the following: The business was established in 1816 by Henri Fredric de Frasse. He came from the Canton, Neufchatel, Switzerland, several years prior to that date, and worked alone as a mechanical expert. It was principally through his efforts that Mr. Robert Fulton's steamboat, "The Claremont," was made a success, as Mr. Frasse made the wooden patterns from which the castings were molded, and finished the pattern engine in its entirety, this being afterward taken to England and used as a model for the "Claremont's" motor. Mr. Frasse also conducted the torpedo experiments which Mr. Fulton did not perfect through his lack of capital. In Lossing's Field Book of the War of 1812 mention is made, "The late Henry F. Frasse, who for many years kept a shop in New York for the sale of watch materials, made the clock work for Mr. Fulton (used in the torpedoes) in an account book before me (the historiographer) is the following entry at the time we are considering: 'Doit Mr. Fulton a H'y Frasse, 26 Mai, 1810. A Fulton repare un turpedos, le grand ressort, volant et roue, $4.50. Mr. Frasse was then the only machinist of note in the city of New York." (Mr. Fulton, debtor to Henry Frasse, repaired a torpedo, the large spring, fly and wheel). In 1843 the business was conducted by the son, William H. Frasse, who like his father was an expert mechanic. He received many medals and diplomas from the American Institute. Notably among the models he exhibited was a low-pressure condensing engine of quarter horse-power for which he received a silver medal. In 1869, owing to his death, the business passed into the control of the widow, S. J. Frasse. In 1890, the firm was composed of Henry F. Frasse (grandson of the founder), A. H. Briggs and S. J. Frasse, by whom the business has been managed until its incorporation. With our increased capital we will be better able than ever to anticipate competition and lead in our line, which place we have held since our inception. We shall continue to carry a full line of high grade tools and supplies suited to the wants of every branch of the mechanical trades.

Machinists' Supplies and Iron.

NEW YORK, February 11, 1893.

Iron—American Pig—We quote Standard Northern brands, No. 1 Foundry, $14.75 to $15.25; No. 2, $14 to $14.50; Gray Forge, $13 to $14. Southern brands of good quality are obtainable at $14.75 to $15 for No. 1 Foundry; $13.75 to $14 for No. 2; and $12.75 to $13 for Gray Forge.

Scotch Pig—Coltness is quoted at $21.75; and $20 for Eglington.

Antimony—The market is steady at a decline. We quote L. X., 10½c. to 10⅝c.; Cookson's, 10½c. to 10⅝c.; Hallett's, 10c. to 10⅛c., and U. S. French Star, 10½c.

Copper—Lake Copper is quoted at 12.10c. to 12¼c.; the best bid is 12c. There is no business reported; both buyers and sellers are indifferent. Casting Copper is held at 11¼c. to 11½c.

Lead—No change in the market; 50 tons have been sold at 3.85c., and 200 tons at 3.95c.; sellers are holding out for 4c.

Lard Oil—Prime City is quoted at $1 to $1.02; Western on spot at 98c. to 99c.

Spelter—The market is weak; there are offerings at the reduced price of 4.30c. for New York delivery. Buyers are indifferent.

Tin—A steady feeling prevails, but the movement is light. Spot price is 20.15c.

WANTED

"Situation and Help" Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Wanted—Salesmen on commission, to push a special line of mach'y. "Kirk," care of AM. MACH.

A first-class draftsman wants situation; machine tools a specialty. Address Box 15, AM. MACHINIST.

Young man, 18, wants situation in mech. drawing-room. Address J. E., AMERICAN MACHINIST.

Mech. eng. 15 years' prac. experience; grad. as sup't, ass't sup't or designer. B., AM. MACHINIST.

Wanted—First-class tool makers and machinists at good wages; steady employment. State age and exp. American Engine Co., Bound Brook, N. J.

Wanted—First class draftsman experienced on Corliss engine work. Address Sioux City Engine Works, Sioux City, Iowa.

Wanted—Situation by first-class tool dresser; can temper and do other work if required. J. K. Bruce, 253 Essex Street, Lawrence, Mass.

Mechanical draftsman of drawing room experi'e wants sit'n in city where the services of a neat and ac'e machine draftsman are req'd. Box 20, AM. MACH.

Wanted—Position as sup't or foreman of machine shop; American, 42 yrs. of age; exp'd in handling men to best advantage & up in mod. shop practice; best refs. Address Box 19, AMERICAN MACHINIST.

Wanted—Three good tool makers; men accustomed to small jig work, punches and dies, etc.; none but first class need apply; send reference with application. N. C. R. Co., Dayton, O.

A foreman machinist wants similar or better position; light or heavy work; energetic and thorough; 35 years old, 10 years in charge of men, and means business. Address "J.," AM. MACHINIST.

Wanted—A position as foreman by a thoroughly prac'l man; had charge of engine, boiler & machine works 16 years; constructing mach'y, engines and boilers; 1st-class des'r. Foreman, Box 17, AM. MACH.

Wanted—A mechanical draftsman familiar with tool design to get up fixtures, jigs, etc., in a steam engine manufactory; must be a mach't. Address with refs. and exp., Draftsman, AM. MACHINIST.

We will pay 50 cents each for copies of the AMERICAN MACHINIST of December 25, 1886, issue; must be unsoiled and in good condition. AMERICAN MACHINIST PUBLISHING COMPANY, 203 Broadway, New York.

Wanted in Penna. a foundry foreman who is accustomed to heavy engine work; only 1st-class man one acquainted with modern methods, need apply; give experience, references and wages expected. Address Foundry, Box 18, AMERICAN MACHINIST.

Wanted, immediately—Competent foreman for machine shop working 25 men; small engine work; permanent position to competent man who is a hustler. Address, stating wages expected, experience, etc., Machinist, Lock Box 324, Chicago, Ill.

Wanted—A foreman in machine shop of an engine manufactory; must be familiar with modern jig and gauge methods, and a pusher; a good place is open for the right man; references will be investigated. Address Ohio, care AM. MACHINIST.

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Meet all requirements more fully and satisfactorily than any other of its competitors.
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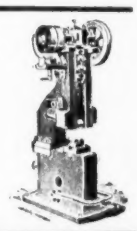

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VERTICAL MILLER
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A valuable Machine for all kinds of Die and Tool Work requiring Milling, Drilling and Profiling; Sliding Head instantly adjusted. 12" on column and table, has micrometer adjustment 6", 12" and 18" cross, lengthwise and vertically by screw. This machine is made in two sizes. No. 1 uses Mills ⅜" and less; No. 2, 1" and less.
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A second-hand Compound Condensing Engine in A1 condition, capable of devoloping 500 to 1000 Horse Powder at a speed of from 150 to 250 revolutions per minute under a steam pressure of say 100 lbs. State maker's name, when built, how much used and where can be seen. Give full description and state lowest spot cash price. Address
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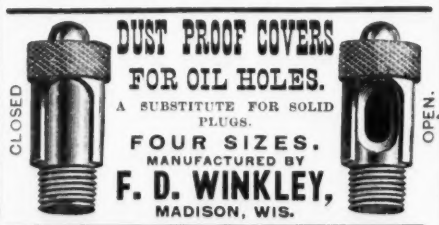

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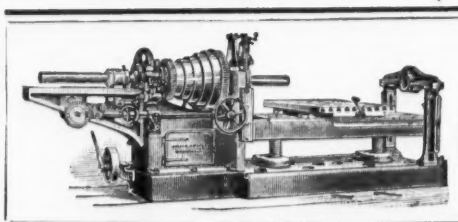

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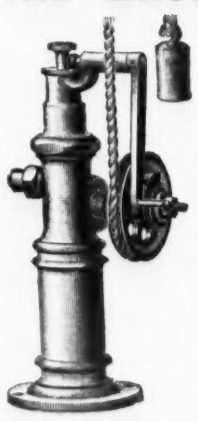
MACHINE TOOL BUILDERS.
IMPROVED PATTERNS! LATE DESIGNS!

THE MASON STEAM DAMPER REGULATOR



Is made in accordence with an entirely novel principle in the construction of damper regulators; the steam is admitted from the boiler, under a diaphragm which is attached to an auxiliary valve, which either lets in the steam or excludes it from the piston which works in the cylinder. This piston being forced down by the steam pressure, and carried back by the weight on the damper lever, turns a wheel, from which runs the chain which is connected to the damper. By an ingenious arrangement, the damper is not thrown entirely open by the slightest change of pressure in the boiler, but is gradually opened, as the pressure changes, thereby not allowing sudden and great variations of draft, whereby the coal is wasted.

We manufacture only one size. The regulators are made of the best steam metal throughout; each one is nickel-plated. Weight, 30 pounds. Price, $80.00, including bracket, weight and 25 feet of chain.

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H. W. JOHNS'
ASBESTOS
ASBESTOS SECTIONAL PIPE COVERINGS.
Non-Conducting Coverings for Steam and Hot Water Pipes, Boilers, etc.
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H. W. JOHNS MANUFACTURING COMPANY,
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87 MAIDEN LANE, N. Y. JERSEY CITY, CHICAGO, PHILADELPHIA, BOSTON, ATLANTA, LONDON.

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Wanted—Position as manager or sup't, by a man with experience in shop, drawing room and business, who knows the value and importance of system, method, discipline and economy to reap dividends, and can practice his preaching. Address Engineer, care AMERICAN MACHINIST.

Wanted—Superintendent or foreman capable of running 60 to 75 men: must understand engine and machine work, general job and foundry and boiler work; a good all round man who is not afraid of work may obtain a good position. Address Box 9, care AMERICAN MACHINIST.

A 1st-class mach. and draftsman may secure a permanent pos. as supt., with a concern mfg. mach'y for saw-mills, flour-mills, also iron work for bridges, buildings, etc.; location within 200 miles of Chicago. "Superintendent," care of *Northwestern Lumberman*, Chicago. State references, exp., and salary.

Wanted—A first-class pattern maker for a shop doing heavy saw-mill and architectural work, also locomotive repair work; one familiar with architectural iron work and some knowledge of drafting preferred; give reference and state age, experience, and salary expected. Georgia Iron Works, Augusta, Georgia.

Wanted—An office man, one who has some exp. in a machine shop & foundry; must be a good penman and have a good knowledge of book-keeping; must be competent to make records of patterns, other office duties, etc.; none but first-class men need apply, giving experience, references and wages expected; no objections to a young draftsman of some experience. Address Box 16, AMER. MACHINIST.

Wanted—A foundry foreman, who is accustomed to general foundry work, including engine cylinders and castings of large and small size, car and building castings, in a foundry employing about 60 molders; applicants must be well up in dry sand and loam work, and understand irons and the most economical methods of melting, and be thoroughly familiar with piece work; none but first-class men need apply; state age, experience, and salary required; a good salary will be paid to the right man. Address X. Y., Box 13, AMERICAN MACHINIST.

✢ MISCELLANEOUS WANTS ✢

Advertisements will be inserted under this head at 35 cents per line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Cheap 2d hd lathes & planers. S. M. York, Clev'd, O.

Auto. Steam Flue Cleaners. Kelley Co., Erie, Pa.

For Sale—Second-hand drill presses, engine lathes and planers. Dietz, Gang & Co., Cincinnati, O.

Light and fine machinery to order; Foot Lathe Catalogue for stamp. E. O. Chase, Newark, N. J.

Engines, special and gen. mach'y designed; ideas developed. A. W. Jacobi, 136 Liberty St., N. Y.

Best Bolt Header in the world for $50. Address C. H. Baush & Sons, Holyoke, Mass.

Wanted—Hardware specialties to build. Send 25 cents for "Eureka Knife and Shears Sharpener." W. A. Smith & Co., 227 Eddy St., Providence, R. I.

Special, experimental or other light machinery manufactured. Best equipped shop in the West for fine work. Manufacture one of the best hollow spindle bench lathes for the tool room or for manufacturing. Write us. Moseley & Co., Elgin, Ill.

Hand planer 15"x16"x34", $75; Sellers screw-cutting lathe, 12" swing, $120; ditto 17" and 20' swing, $110 and $155; ditto 25" and 30" swing, $350 each; boiler and engine, 12 horse, $150; 1½ horse engine, $25; bench lathes cheap; sale or exchange. 229, AMERICAN MACHINIST.

DESIRABLE SECOND-HAND MACHINERY.

LATHES.

1 15 in. x 5 ft. Windsor, Rise and Fall Rest.	A1 condition
1 17 in. x 6 ft. Fitchburg, Compound Rest.	A1 condition
1 16 in. x 7 ft. Bement, Plain Rest, heavy fine Tool.	A1 condition
1 17 in. x 8 ft. Blaisdell, Rise and Fall Rest.	Good as new
1 13 in. x 4 ft. Prentice, Plain Turning Lathe.	A1 condition
2 10 in. x 3½ ft. Garvin, Hand Lathes.	Good as new

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1 30 in. x 30 in. x 8 ft. Hewes & Phillips, one head on rail, a fine modern Tool.	Good as new
1 40 in. x 36 in. x 10 ft. New Haven, one head, a heavy Tool.	Good order
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1 24 in. x 24 in. x 6 ft. Pease, one head.	A1 condition
1 15 in. x 15 in. x 3 ft. Wilkinson.	A1 condition

MISCELLANEOUS.

1 No. 1 Garvin Universal Milling Machine.	Good as new
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1 Merritt Heavy Back-Geared Milling Machine.	A1 condition
1 3 in. Hurlbut & Rogers Cutting-Off Machine.	A1 condition
1 22 in. Gould & Eberhardt Automatic Gear Cutter.	Good as new
1 Pratt & Whitney 2 Spindled Centering Machine.	Good as new
1 No. 1 Garvin Plain Screw Machine	Good as new
1 No. 3 Windsor Screw Machine, Wire Feed, Automatic Chuck, very complete.	Good as new
1 No 3 Pratt & Whitney Plain Screw Machine.	A1 condition
1 No. 4 Garvin 6-Spindle Drill-Press.	Good as new
1 No. 3 Garvin 4-Spindle Drill-Press.	Good as new
1 No. 2 Brown & Sharpe Surface Grinder.	A1 condition

Nearly 500 New and Second hand Tools in Stock.
Write us, we are always ready to trade.

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7 ft. x 7 ft. x 16½ Planer — 3 Heads, Niles A1.
72 in. x 48 x 33 ft. Planer — 3 do
54 in. x 42 in. x 24½ ft. do — 2 do
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30 in. x 30 in. x 8 ft. do — 1 Head.
26 in. x 24 in. x 7 ft. do — 1 do
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90 in. x 30 ft. Triple Gear Engine Lathe, Ames A1.
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60 in. x 45 ft. Double Engine Lathe.
52 in. x 35 ft. Engine Lathe Horizontal Boring Machine, one end.
42 in. x 20 ft. Engine Lathe.
50 in. x 30 ft. Bed, Triple Geared. New Engine Lathe.
30 in. x 28 ft. D. W. Pond Shafting Lathe.
32 in. x 12, 14, 16, 18 ft. Bed. New Engine do
25 in. x 12, 16, 20 and 24 ft. Bed. do do do
21 in. x 10, 12 ft. Bed. do do do
20 in. x 7½ & 8 ft. do 2d Hand do do
18 in. x 6, 7 & 8 ft. do New & do do do
17 in. x 8 ft. do do do do
16 in. x 6 & 8 ft. do do do do do
15 in. x 6 & 8 ft. do do do do do
14 in. x 6 ft do do do do do
Car Axle Lathe, Bement.
15, 16, 18, 25 in. Crank Shapers.
20, 24, 25 & 30 in. Geared Shapers.
20, 22 24, 28, 30 & 36 in Drills.
Bolt Cutters.
8 and 13 in. Stroke Slotters.
Lot of Lincoln Pattern Millers.
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40 H. P. Vert. Engine. N. Y. S. S. P. Co.
11 in. x 18 in. Hor. Engine. A1 Order.
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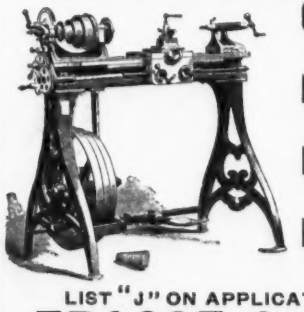

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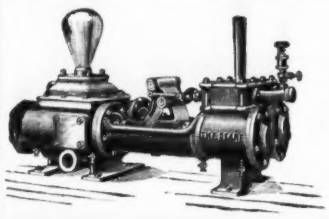

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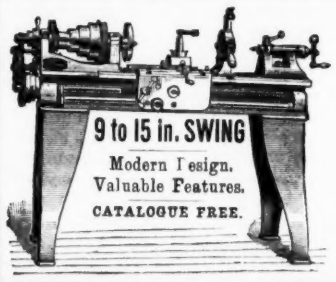

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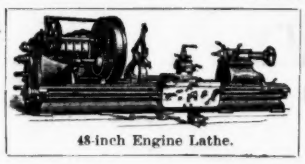
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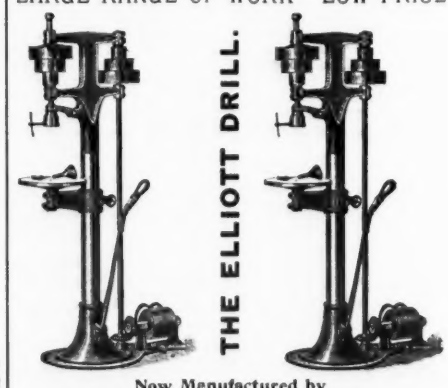

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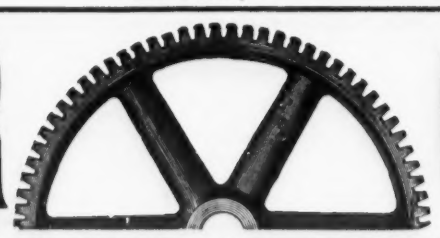

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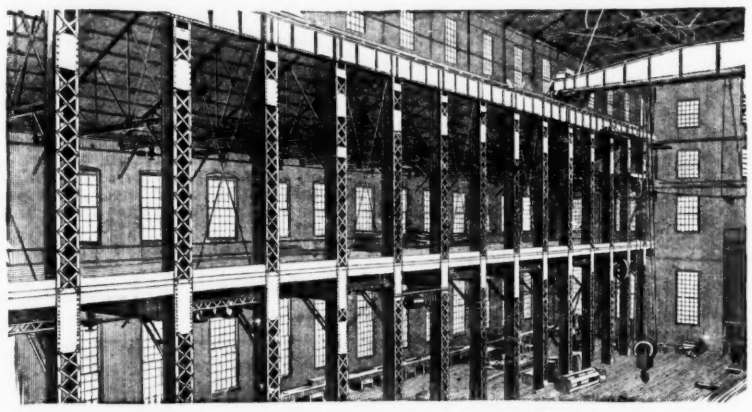

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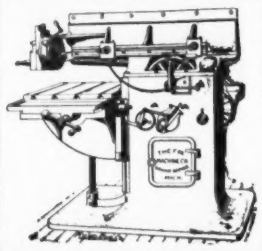

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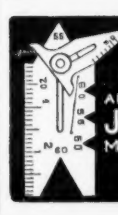

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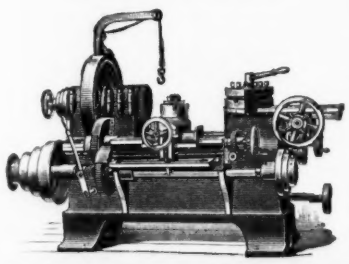

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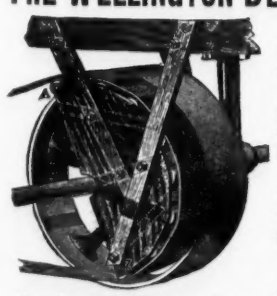

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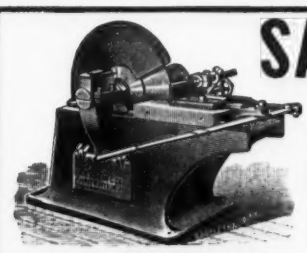

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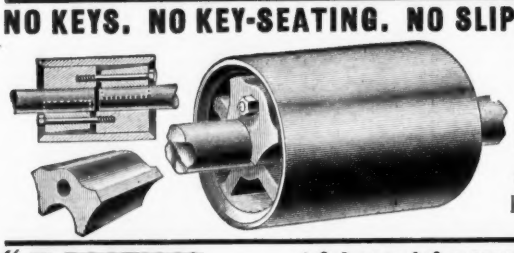

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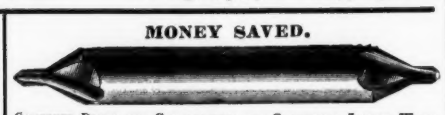

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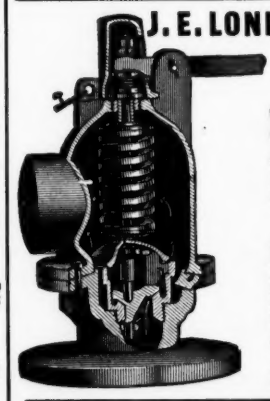

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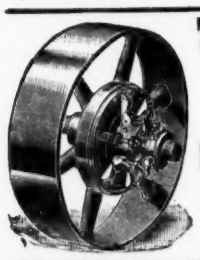

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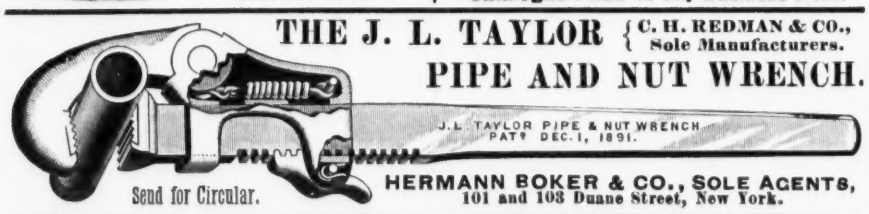

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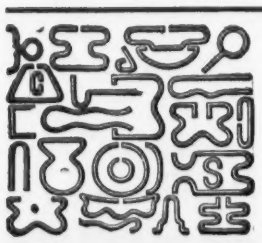

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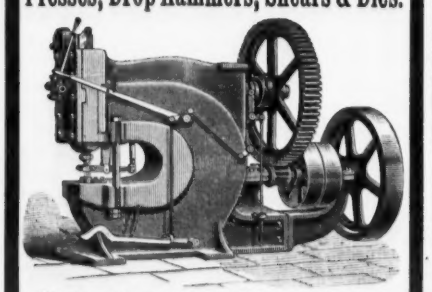

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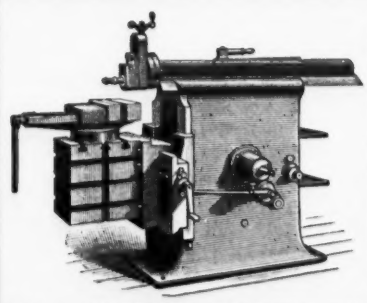

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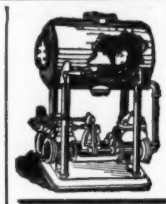

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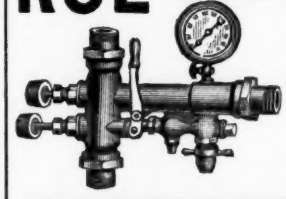

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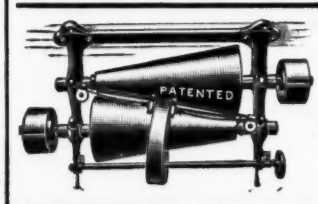

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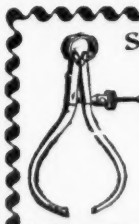

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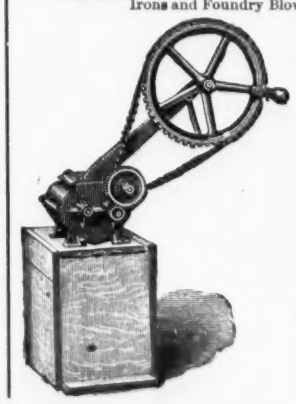

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4	6½ "	0 to 2 "
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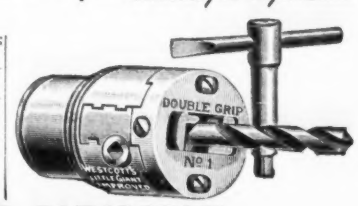

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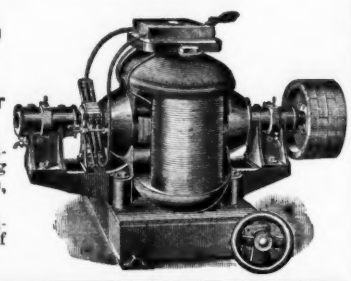

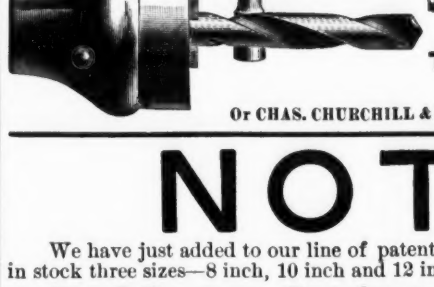

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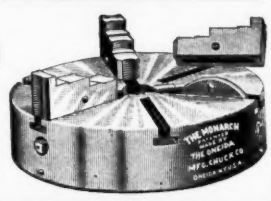

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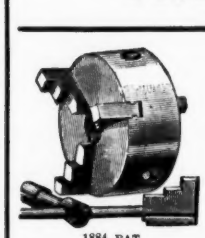

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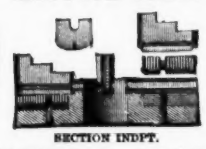

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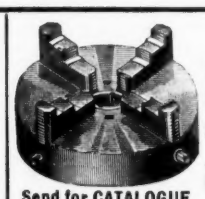

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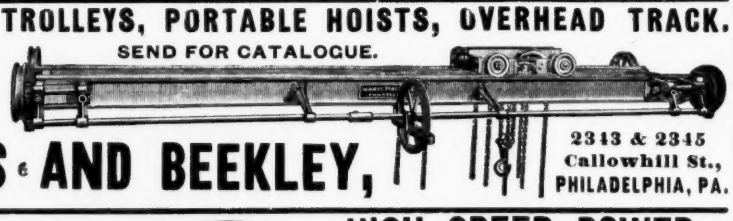

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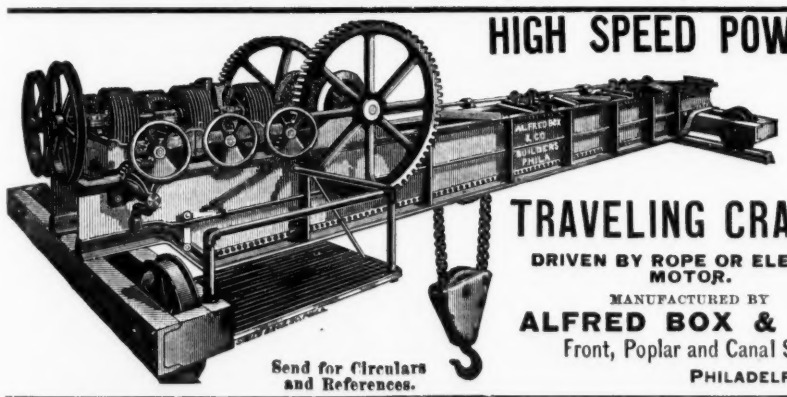

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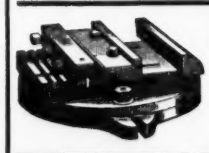

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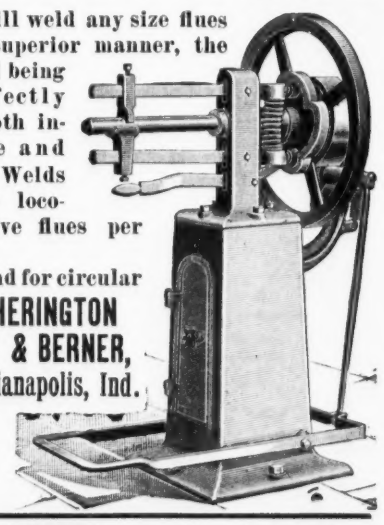

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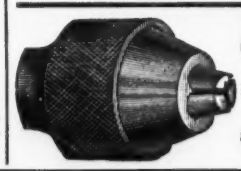

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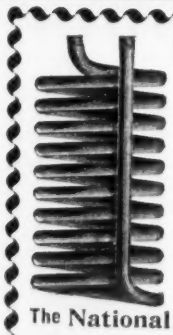

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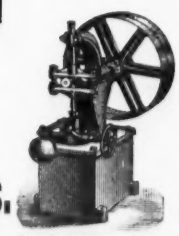

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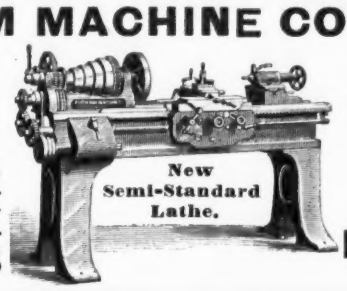

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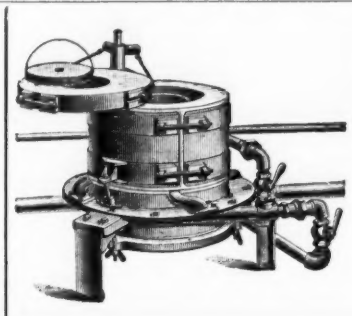

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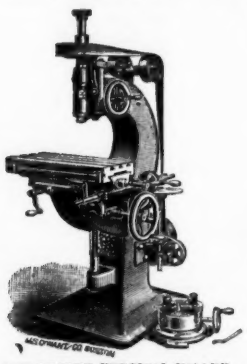

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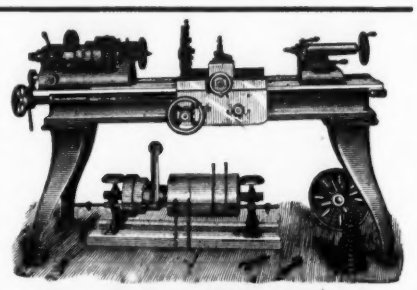

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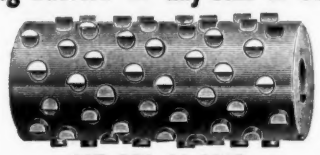

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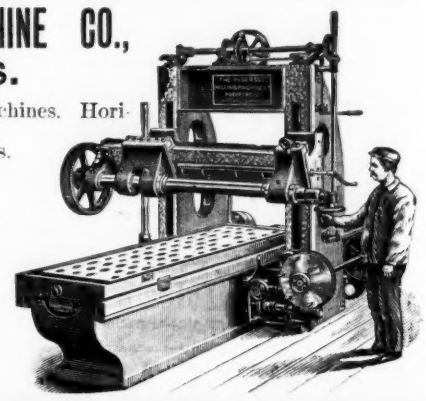

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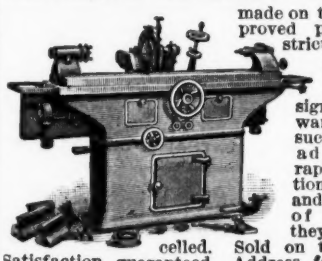

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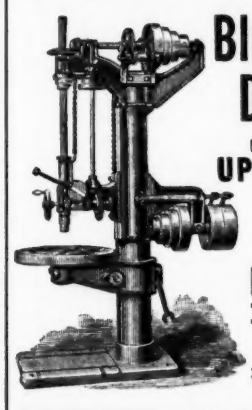

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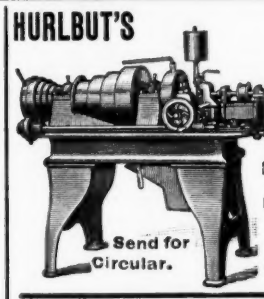

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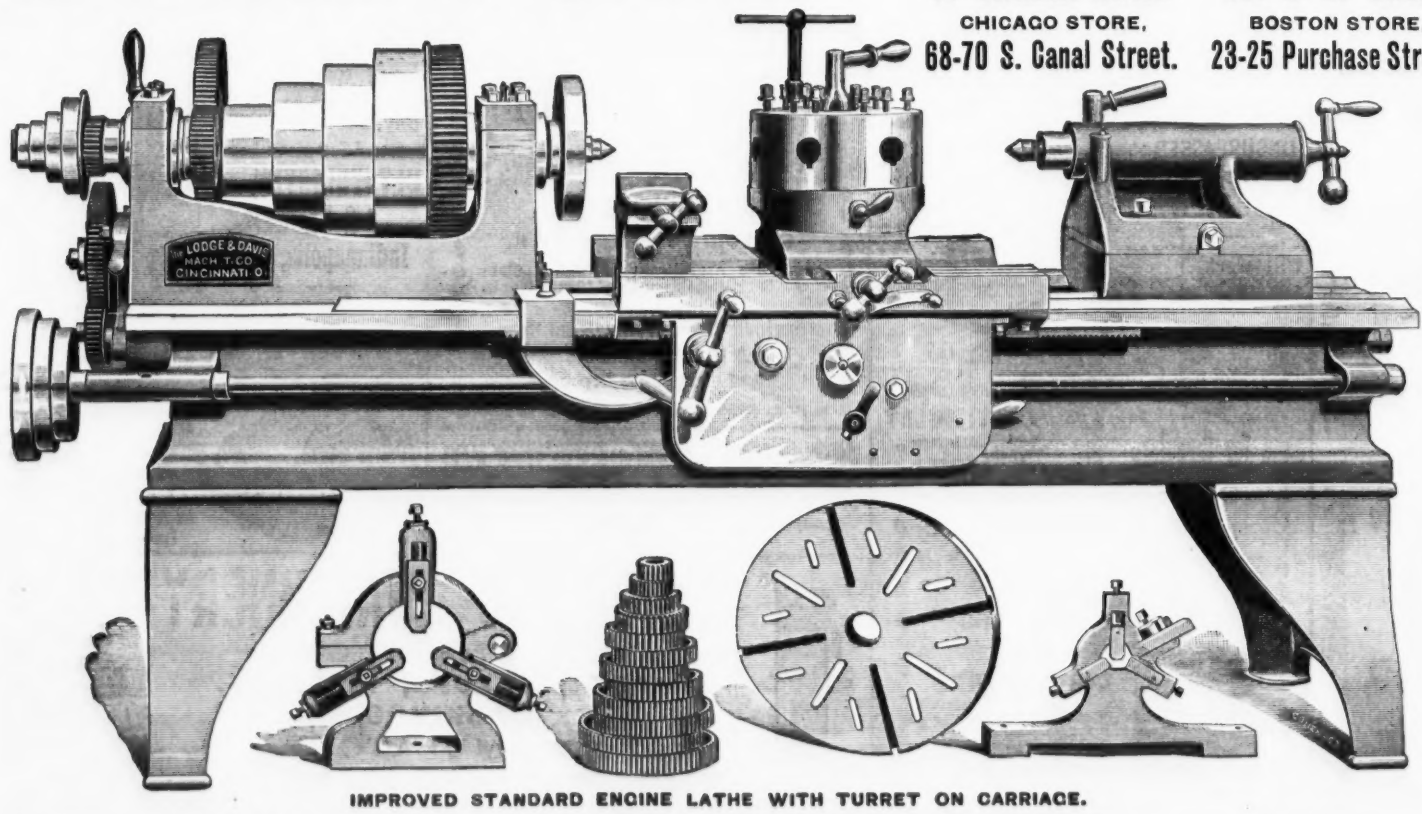

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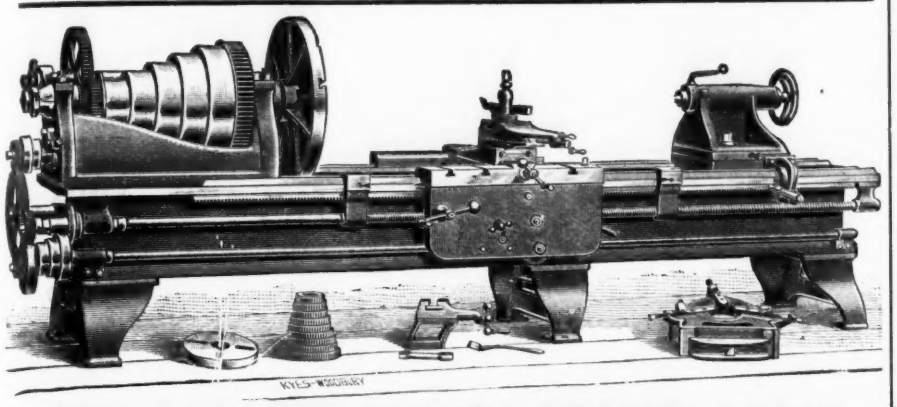

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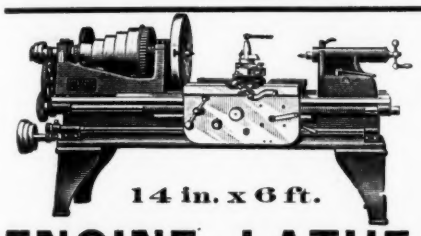

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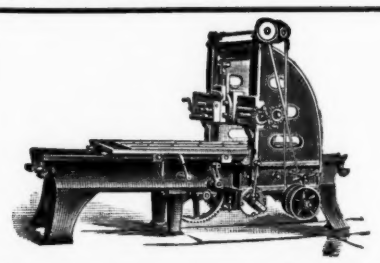

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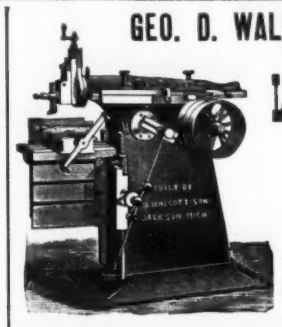

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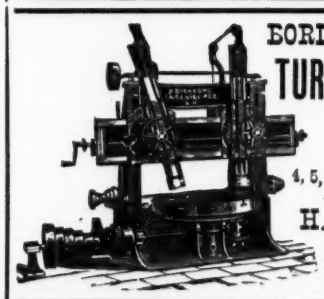

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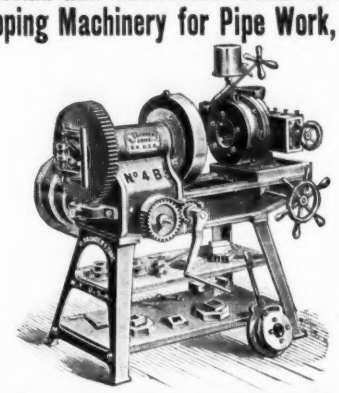

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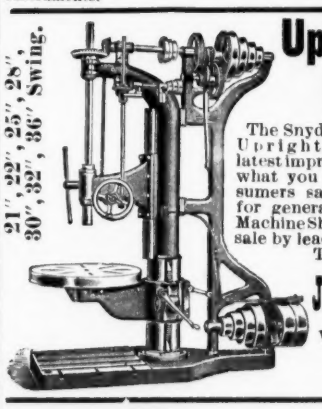

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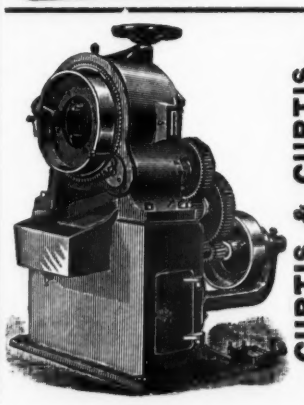

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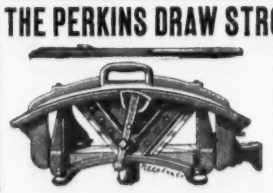

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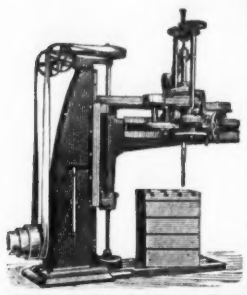

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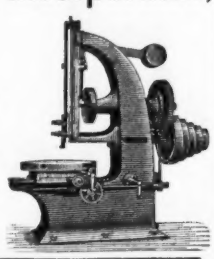

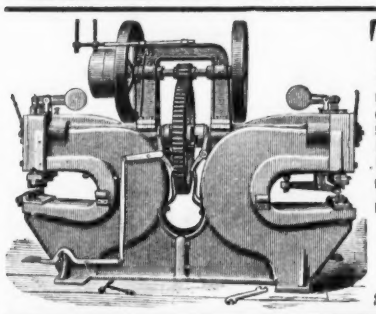

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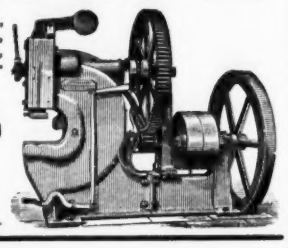

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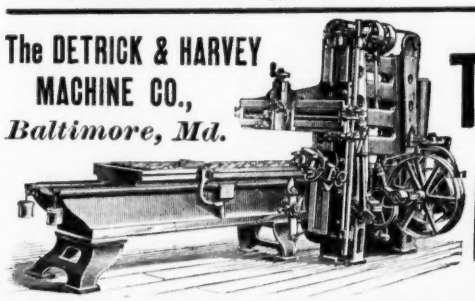

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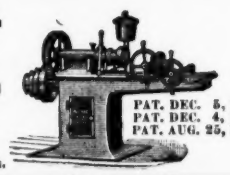

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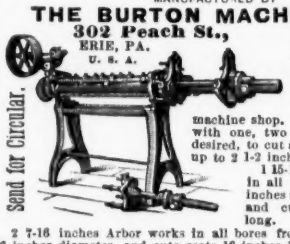

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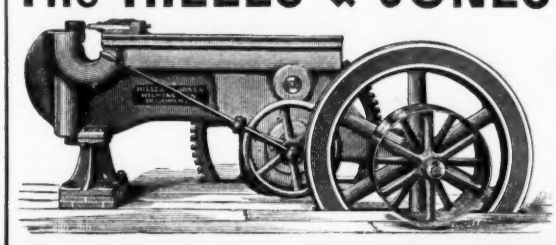

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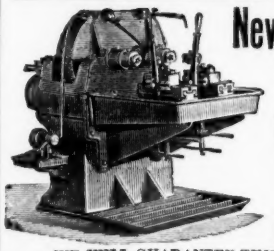

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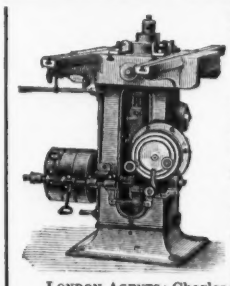

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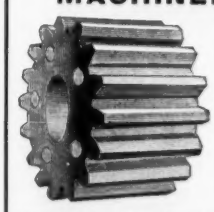

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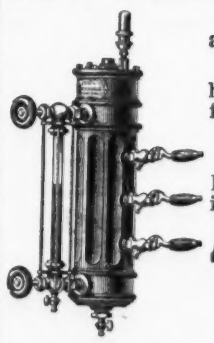

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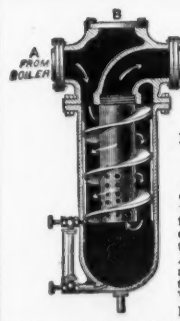

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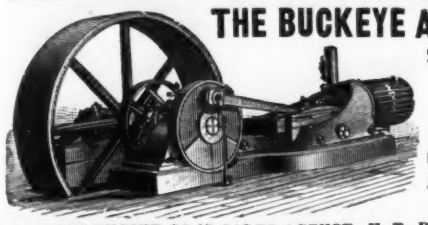

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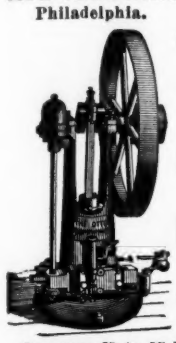

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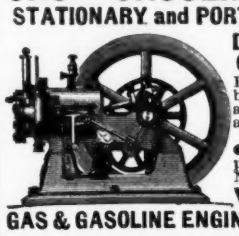

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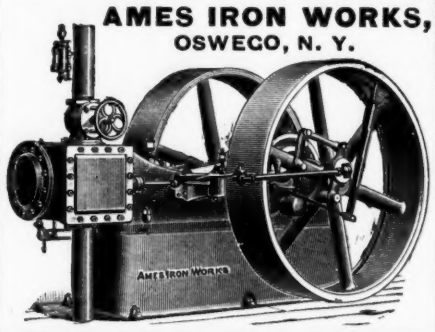

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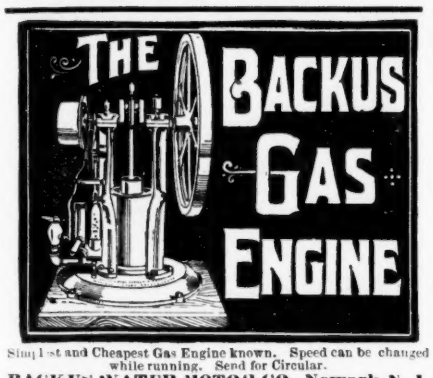

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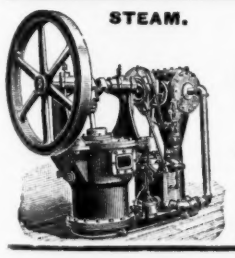

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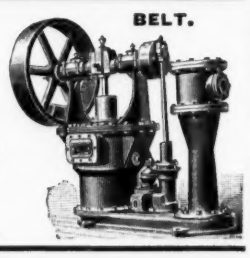

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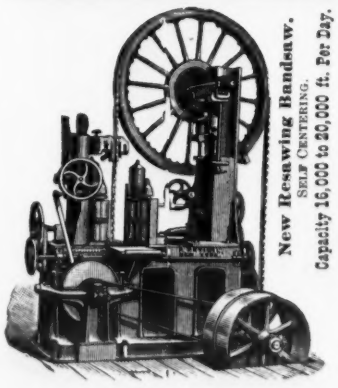

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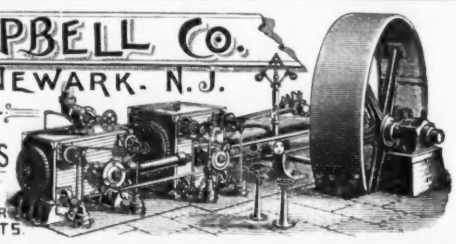

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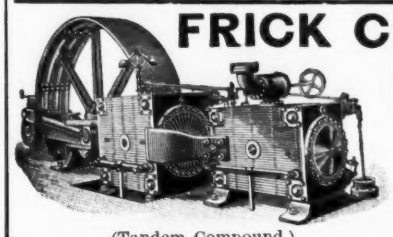

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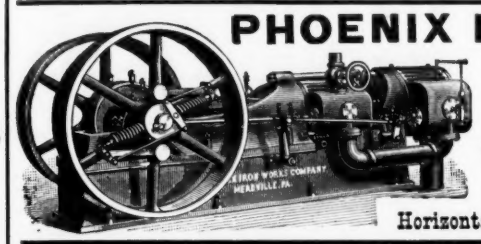

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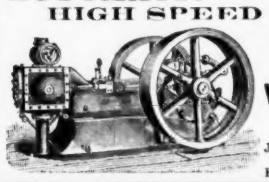

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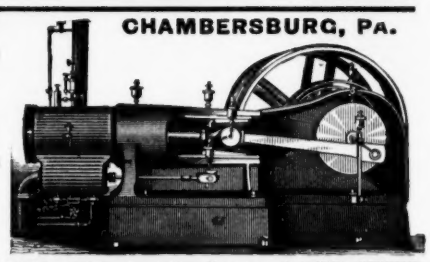

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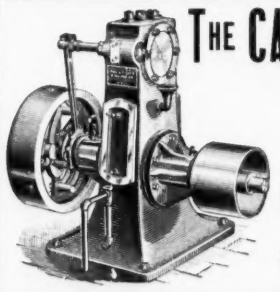

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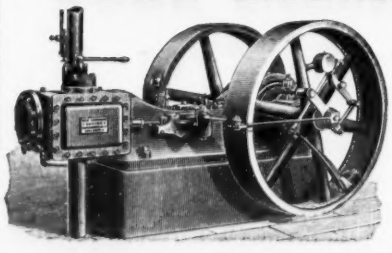

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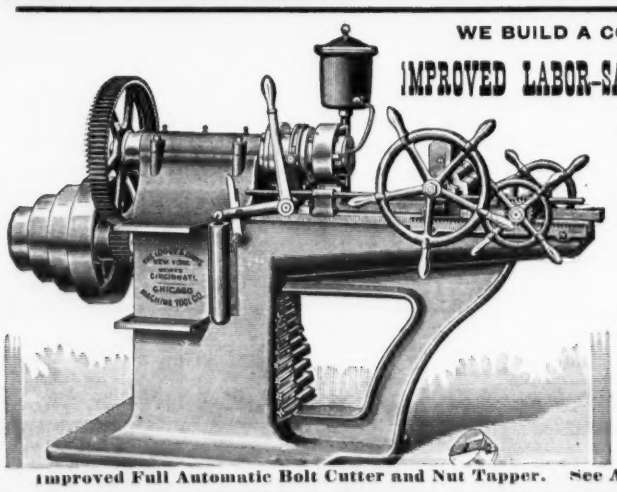

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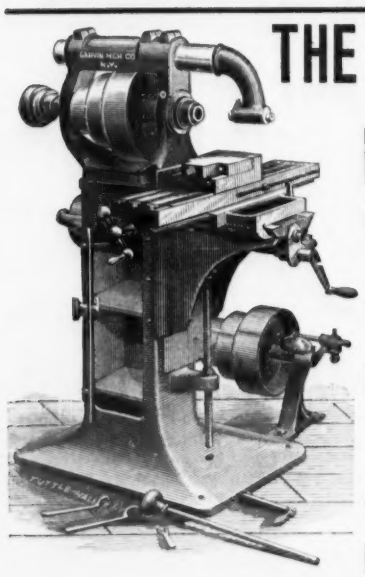

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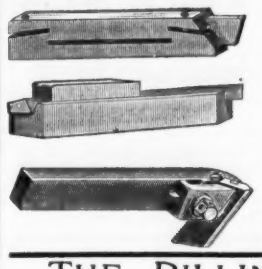

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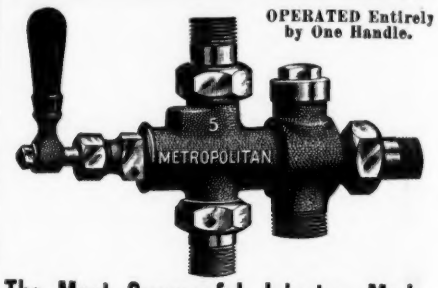

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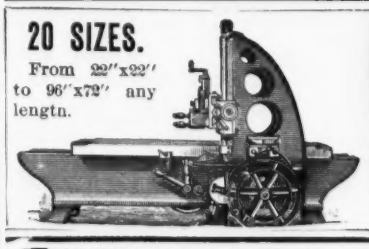

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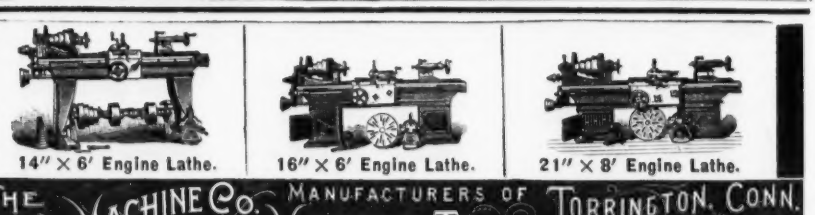

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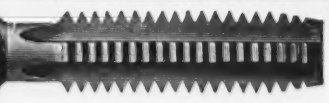

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